

SOURCE CONTROL GROUNDWATER REMEDIATION FINAL DESIGN

501 ELLIS STREET MOUNTAIN VIEW, CALIFORNIA

Submitted In Fulfillment Of
The Requirements Of U.S. EPA
CERCLA §106 Order, Docket No. 91-4

Prepared for

NEC Electronics Inc.

By

Bechtel Environmental, Inc.

San Francisco, CA



August 1996



SOURCE CONTROL GROUNDWATER REMEDIATION FINAL DESIGN

501 ELLIS STREET MOUNTAIN VIEW, CALIFORNIA

Submitted In Fulfillment Of
The Requirements Of U.S. EPA
CERCLA §106 Order, Docket No. 91-4

Prepared for

NEC Electronics Inc.

By

Bechtel Environmental, Inc.

San Francisco, CA



August 1996

384 pages

SOURCE CONTROL GROUNDWATER REMEDIATION FINAL DESIGN

501 ELLIS STREET MOUNTAIN VIEW, CALIFORNIA

Submitted In Fulfillment Of The Requirements Of U.S. EPA CERCLA §106 Order, Docket No. 91-4

Prepared for

NEC Electronics Inc.

By

Bechtel Environmental, Inc.

San Francisco, CA

August 1996

This document was prepared in compliance with Section IX.D.2.b.(2) and (3) of the Administrative Order for Remedial Design and Remedial Action, EPA Docket No. 91-4.

CERTIFICATION

THIS DOCUMENT WAS PREPARED UNDER THE DIRECTION AND SUPERVISION OF A QUALIFIED PROFESSIONAL ENGINEER



JANET L. ARGYRES, P.E. PROJECT MANAGER PROFESSIONAL ENGINEER (38414)

Table of Contents

Section	n			Page	
	Executive Summary				
	1.0	Purpose	5	ES-1	
	2.0	Goal		ES-1	
	3.0	Scope		ES-1	
1	Introduction				
	1.1	Purpose	9	1-1	
	1.2	§106 O	rder Requirements	1-2	
	1.3	Reference Documents			
	1.4	Report Organization1			
2	Site Background				
	2.1	Site Description and Background2-1			
	2.2	Summary of Findings from Groundwater Investigations			
		2.2.1	Geology	2-2	
		2.2.2	Hydrogeology	2-2	
		2.2.3	Groundwater Quality	2-5	
3	SCGWR Final Design				
	3.1	Design	Basis	3-1	
		3.1.1	Influent Flow Rates	3-1	
		3.1.2	Influent Concentrations	3-2	
		3.1.3	Effluent Concentrations	3-3	
	3.2	SCGWI	R Process Description	3-3	
	3.3	Design	Criteria	3-4	
		3.3.1	Applicable Codes and Standards	3-4	
		3.3.2	Major Equipment	3-5	

	3.4	Extraction Well Design
		3.4.1 Location
		3.4.2 Pumping Rate
		3.4.3 Well Construction Design
	3.5	Groundwater Extraction and Conveyance Piping Design 3-7
		3.5.1 Well Pumps
		3.5.2 Well Head Vaults and Instrumentation
		3.5.3 Groundwater Collection Piping
		3.5.4 Treatment Plant Piping
	3.6	Groundwater Treatment Plant Design3-9
		3.6.1 Site Plan Description
		3.6.2 Major Treatment Plant Equipment
		3.6.3 Instrumentation and Control Design
	3.7	System Down-Time Analysis3-11
4	Site M	anagement and Quality Assurance Plan4-1
	4.1	Project Organization4-1
	4.2	Site Management, Maintenance and Security4-1
	4.3	Construction Impact Mitigation Program4-2
		4.3.1 Stormwater Management
		4.3.2 Dust Control
		4.3.3 Spill Prevention and Control
		4.3.4 Waste Management
	4.4	Safety and Health4-4
	4.5	Quality Assurance Program4-4
		4.5.1 Construction Quality Assurance 4-4

		4.5.2	Compliance Monitoring Quality Assurance	4-5		
		4.5.3	Safety and Health Monitoring Quality Assurance	4-6		
5.0	Attai	Attainment of ARARs, Permits, and Performance Standards				
	5.1	Chemi	5-1			
	5.2	Action	Action-Specific ARARs			
		5.2.1	Construction of Groundwater Treatment System			
			and Conveyance Piping	5-2		
		5.2.2	Extraction Well Construction and Installation	5-2		
		5.2.3	Groundwater Treatment and Discharge	5-4		
		5.2.4	Off-site Disposal of Excavated Soils	5-5		
	5.3	B Location-Specific ARARs				
	5.4	Other	Permits and Requirements	5-6		
		5.4.1	California Safe Drinking Water and Toxic			
			Enforcement Act	5-6		
		5.4.2	City of Mountain View Building Permit	5-6		
	5.5	Perfor	mance Standards for Groundwater	5-7		
		5.5.1	Demonstration of Compliance	5-7		
6	Site I	Site Environmental Monitoring Plan6-1				
	6.1	Monit	oring Well Networks	6-1		
	6.2	Hydraulic Containment Network6-1				
	6.3	Groundwater Quality Network6-2				
	6.4	Analytical Program6-3				
	6.5	Data Evaluation and Reporting6				
7	Sche	edule7-1				
8	Refe	References				

Tables

- 1-1 Cross-Reference to §106 Order Requirements
- 2-1 Vertical Hydraulic Gradients in A and B Aquifer Well Pairs (May 25, 1995)
- 2-2 TCE Concentrations in Groundwater Prior to and Following Remediation of Vadose Zone Soils at 501 Ellis Street
- 2-3 Groundwater Monitoring Results for A Aquifer Wells (July 1995)
- 5-1 Summary of Identified Permits
- 5-2 Maximum Contaminant Levels (MCLs) for §106 Order Organic Chemicals of Concern
- 5-3 NPDES General Permit Effluent Discharge Limits Order No. 94-087
- 6-1 Well Information Summary
- 6-2 Target Compound List and Detection Limits for EPA Method 8010
- 6-3 Target Compound List and Detection Limits for EPA Method 8020

Figures

- 2-1 Groundwater Elevation Contours A-Aquifer May 1995
- 2-2 Water Levels in "A" Aquifer March 21, 1996
- 2-3 TCE Concentration Contours (July 1995 Results)
- 3-1 Well Locations and Estimated Capture Zones
- 3-2 Extraction Well Design
- 3-3 Extraction Well NEC22AE Schematic
- 6-1 Monitoring Well Networks
- 7-1 Final Design Schedule

Appendices

- A Aquifer Test Results
- B Drawings
- C Equipment Descriptions
- D Specifications
- E Quality Assurance/Quality Control Plan
- F Waste Management Plan
- G Permits
- H Adjacent Property Access
- I Responses to EPA Comments

Executive Summary

1.0 PURPOSE

This Source Control Groundwater Remediation (SCGWR) Final Design package has been prepared by Bechtel Environmental, Inc. (Bechtel) for NEC Electronics Inc. (NEC) in response to the requirements of Section IX.D.2.b(2) and (3) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) §106 Administrative Order for Remedial Design and Remedial Action in the matter of Middlefield-Ellis-Whisman (MEW) Study Area, U.S. Environmental Protection Agency (EPA) Docket No. 91-4, dated November 29, 1990 (§106 Order). This design package represents the last Source Control Remedial Design (SCRD) submittal for facility-specific groundwater remediation at NEC's former property at 501 Ellis Street, Mountain View, California. With EPA consent, the components of the intermediate and final design have been combined into one submittal ("Source Control Groundwater Remedial Final Design" or "SCGWR Final Design") to eliminate unnecessary or redundant components, and to accelerate the remedial design process.

2.0 GOAL

The goal of the activities and procedures proposed in the SCGWR Final Design is to address elevated volatile organic compound (VOC) concentrations in groundwater beneath the 501 Ellis Street site. The proposed groundwater extraction and treatment system is designed to effectively control and contain elevated concentrations of VOCs in the area of the 501 Ellis Street building, and to complement the regional groundwater remediation program for the MEW Area.

3.0 SCOPE

This Final Design package presents a groundwater remediation system for the 501 Ellis Street site. Major components of the package include final detailed design of a groundwater extraction system, including the proposed well locations, well design, pumps and associated valves and piping; and treatment system. Construction specifications, quality assurance/quality control plan, waste management plan, completed permit applications, as well as a proposed environmental monitoring plan for evaluating the effectiveness of the groundwater extraction and treatment system are included in the Final Design package.

The proposed system will consist of groundwater extraction, treatment by activated carbon adsorption, and discharge to the publicly owned treatment works (POTW). Groundwater will be

extracted from three wells screened in the A aquifer (NEC1AE, NEC22AE, and NEC27AE) and will be conveyed by double-contained underground piping to the groundwater treatment plant located in the northeast corner of the 501 Ellis Street site. The treatment plant consists of a holding tank, pump, cartridge filter, and three activated carbon canisters in series. The treated effluent will be discharged to an existing on-site sanitary sewer that is connected to the POTW system. The effective operation of the SCGWR system will result in the attainment of performance standards.

Introduction

1.1 PURPOSE

This Final Source Control Groundwater Remediation Design package has been prepared by Bechtel Environmental, Inc. (Bechtel) for NEC Electronics Inc. (NEC) in response to the requirements of Section IX.D.2.b(2) and (3) of the CERCLA §106 Administrative Order for Remedial Design and Remedial Action in the matter of Middlefield-Ellis-Whisman (MEW) Study Area, U.S. Environmental Protection Agency (EPA) Docket No. 91-4, dated November 29, 1990 (§106 Order). This design package represents the last Source Control Remediation Design (SCRD) submittal for facility-specific groundwater remediation at NEC's former property at 501 Ellis Street, Mountain View, California.

The §106 Order outlines specific design elements for the SCRD, including final construction plans and specifications for source control; and requires the SCRD to be submitted in three phases: preliminary, intermediate, and final. The preliminary design, which presented the design basis and conceptual approach to source control, was previously submitted to the EPA and was approved on March 4, 1996. With EPA consent, the components of the intermediate and final design have been combined into one submittal ("Source Control Groundwater Remediation Final Design" or "SCGWR Final Design") to accelerate the remedial design process. Thus, this SCGWR Final Design comprises the remaining two phases of the Source Control Remedial Design requirements.

The goal of the activities proposed in the SCGWR Final Design is to address elevated volatile organic compound (VOC) concentrations in groundwater beneath the 501 Ellis Street site. The proposed groundwater extraction and treatment system is designed to effectively control and contain elevated concentrations of VOCs in the area of the 501 Ellis Street building, and to complement the regional groundwater remediation program.

This Final Design package presents a groundwater remediation system to address elevated VOC concentrations in groundwater at the 501 Ellis Street site. Major components of the package include:

- Final detailed design of a groundwater extraction system, including the proposed well locations, well design, pumps and associated valves and piping;
- Final detailed design of a groundwater conveyance piping and treatment system;

- An evaluation of applicable or relevant and appropriate requirements (ARARs) and permitting requirements;
- Construction specifications, quality assurance/quality control (QA/QC) plan, waste management plan, completed permit applications in support of the final design; and
- A proposed environmental monitoring plan and approach for evaluating the
 effectiveness of the groundwater extraction and treatment system relative to
 Performance Standards.

1.2 §106 ORDER REQUIREMENTS

Table 1-1 presents intermediate and proposed final design requirements from the §106 Order and the corresponding Section or Appendix of the SCGWR Final Design package that addresses the requirement.

1.3 REFERENCE DOCUMENTS

Reference documents that have been prepared for 501 Ellis Street site and/or for the MEW Study area that were used in the development of this intermediate and proposed final design package are listed below:

Phase II Ground Water Investigation, Electronic Arrays Facility, Mountain View, California, J.H. Kleinfelder & Associates, March 1983.

Hydrogeologic and Chemical Data Review and Analysis for the NEC Site, Mountain View, California, Bechtel National, Inc., October 1985.

Soil and Ground-water Chemistry and Hydrogeologic Investigations, NEC Electronics, Inc., Mountain View, California, Bechtel National, Inc., April 1986.

Remedial Investigation/Feasibility Report, Middlefield-Ellis-Whisman Area, Mountain View, California, Harding Lawson Associates, July 1987.

Phase III Hydrogeologic Investigation Field Documentation Report, Bechtel Environmental, Inc., September 1989.

Administrative Order for Remedial Design and Remedial Action, Docket No. 91-4, U.S. Environmental Protection Agency, December 1990.

Long Term Pumping Test Report 501 Ellis Street, Mountain View, California, Bechtel Environmental, Inc., June 1991.

Phase IV Soil Investigation 501 Ellis Street, Mountain View, California, Bechtel Environmental, Inc., July 1991, and Addendum 1, revised June 1995.

Source Control Workplan Addendum A: Summary of Hydrogeology and Addendum B: Saturated Soil Sampling Plan, Bechtel Environmental, Inc., September 1991.

Soil Remediation Report for 501 Ellis Street, Mountain View, California, Bechtel Environmental, Inc., March 1992, and Addendum 1, revised June 1995.

NEC Electronics Inc., Routine Ground-Water Monitoring Report, First Half 1992, Bechtel Environmental, Inc., June 1992. (Also quarterly groundwater monitoring data from December 1992 to July 1995).

Water Production and Potential Water User Survey Results, Water Reuse Program, Middlefield-Ellis-Whisman Site, Mountain View, California, Canonie Environmental, August 1992.

Saturated Soil Investigation, Revision 1, 501 Ellis Street, Mountain View, California, Bechtel Environmental, Inc., Revised June 1995.

Source Control Groundwater Remediation Prelminary Design, 501 Ellis Street, Mountain View, California, Bechtel Environmental, Inc., January 1996, and Addendum 1, February 1996.

1.4 REPORT ORGANIZATION

The SCGWR Final Design package addresses the elements specified in Section IX.D.b (2) and (3) of the §106 Order. In addition, the package contains supporting analysis and information pertinent to the design of the SCGWR system.

Section 1 describes the purpose of the SCGWR, provides a cross-reference to §106 Order requirements, and lists the documents used to develop this final design package. Section 2 of this document provides a site description, background, and a summary of results from previous hydrogeologic investigations conducted at the 501 Ellis Street site, including a summary of the recently conducted aquifer tests. Section 3 presents a system overview and detailed description of the groundwater extraction conveyance and treatment system design parameters. A site management and quality assurance plan are included as Section 4. Section 5 provides an evaluation of ARARs and permitting plan. Section 5 also describes how the proposed system will attain applicable performance standards. Section 6 presents an environmental monitoring plan to demonstrate SCGWR system effectiveness. Finally, Sections 7 and 8 provide the overall

project schedule and a list of references, respectively. Tables and figures are in separate sections following Section 8.

Appendices A through I are included as part of the SCGWR final design package. Appendix A presents the results of the aquifer tests proposed in the Preliminary Design. Final design drawings are included in Appendix B. Appendix C contains an equipment list and catalog cuts. Appendix D presents the specifications for construction and installation of the groundwater treatment system. The SCGWR QA/QC Plan and Waste Management Plan are provided in Appendices E and F, respectively. Completed permit applications are included in Appendix G, and provisions for access to adjacent properties are included in Appendix H. Appendix I documents the EPA's comments on the Draft SCGWR Final Design and NEC's responses to the EPA comments.

Site Background

2.1 SITE DESCRIPTION AND BACKGROUND

The 501 Ellis Street site is situated on a relatively flat tract of land that slopes gently to the north towards San Francisco Bay. The Bay is approximately two miles to the north, and the Santa Cruz Mountains are approximately six miles to the south. Drawing G-001 (in Appendix B) shows the location of the 501 Ellis Street site. The property is approximately two acres in size, consisting mainly of a building and a paved open area. A large single-story building occupies the western portion of the property. The surrounding properties are occupied primarily by other electronics industries.

The 501 Ellis Street site is currently owned by Renault & Handley Employees Investment Co. (Renault & Handley). The building is unoccupied and utility connections such as telephone, electricity, and natural gas are no longer operational. Twenty groundwater monitoring wells are located on the 501 Ellis Street site. Underground conduits and abandoned utility trenches are located along the north and east sides of the building. An elevated concrete pad is adjacent and attached to the north side of the building. The plot plan (Drawing C-001, Appendix B) shows the location of the monitoring wells and the underground utilities at the 501 Ellis Street site.

2.2 SUMMARY OF FINDINGS FROM GROUNDWATER INVESTIGATIONS

Several studies have been conducted to characterize the geology and hydrogeology at the site and in the vicinity, to determine the chemical compounds present in groundwater beneath the property, and to assess the extent and concentrations of chemicals present. Site specific geology and hydrogeology are summarized in the *Phase III Hydrogeologic Investigation* (Bechtel 1989) and the *Source Control Work Plan, Addendum A: Summary of Hydrogeology* (Bechtel 1991c).

Vadose zone soils behind the building at the 501 Ellis Street site were remediated in 1991. Two areas which were identified during the *Phase IV Investigation* (Bechtel 1991b), located near the eastern corner of the building and at the southeastern property boundary, were addressed. The area at the southeast corner of the building is coincident with the highest VOC concentrations in the A aquifer.

Water levels and groundwater quality have been routinely monitored since 1982 until the completion of the 1991 soil remediation. The sampling program consisted of a combination of

quarterly, semi-annual and annual sampling events of NEC monitoring wells. Subsequent to the December 1991 soil remediation, nine groundwater sampling events (from June 1992 to July 1995) have also been conducted, as well as quarterly water level measurements.

The results of previous groundwater investigations at the 501 Ellis Street site are summarized below.

2.2.1 Geology

The sediments beneath the site are composed of varying proportions of unconsolidated to poorly consolidated gravel, sand, silt and clay typical of alluvial, estuarine, and bay deposits. The interbedded materials are often lenticular, laterally gradational, anisotropic, and heterogeneous. The total thickness of these deposits is about 1,000 feet.

The major groundwater flow zone in the A aquifer ranges from 3 to 10 feet thick within the aquifer, and is composed of silty sand (SM), sand (SP), and gravel (GP) with interbedded layers of silty clay (CL), silt (ML) and gravely silt (ML).

2.2.2 Hydrogeology

The discussion of hydrogeology is presented as findings prior to and subsequent to 1991. Soil remediation was completed in 1991, and no further groundwater or soil investigations have been conducted. However, groundwater levels and quality have been monitored since 1991, and the data have not been documented in any report prior to the preliminary and final design packages.

A summary of site hydrogeology based on data collected prior to 1991, as well as more recent 1995 data, is presented below.

Findings Prior to 1991

The water-bearing materials beneath the MEW region (including 501 Ellis Street site), are divided into an upper aquifer zone, comprising the A and B aquifers and their associated aquitards, and a lower aquifer zone, consisting of the C and deeper aquifers and their associated aquitards.

Hydrogeologic data collected from site monitoring wells confirm the presence of upper zone aquifers A, B1, B2, and B3, delineated previously in the MEW region. The upper aquifer zone is separated from the lower aquifer zone by the B-C aquitard beneath the region. The A aquifer at the 501 Ellis Street site is approximately 15 to 20 feet thick, extending from a depth of approximately 12 feet (elevation 32 feet above mean sea level) to a maximum depth of about 32 feet.

Groundwater recharge to the aquifer units is from inflow from the south and surface infiltration (in unpaved areas). Groundwater discharge from the near-surface aquifers includes evapotranspiration, discharge to San Francisco Bay, vertical leakage between aquifers, and minor discharge by wells.

Horizontal flow to the north predominates in the groundwater system. A potential for limited vertical flow exists between the aquitard units. The average vertical hydraulic gradient at the site was determined to be 0.03 feet per feet (ft/ft) and 0.11 ft/ft upward from the B1 to the A aquifer and B2 to B1 aquifer, respectively; and was 0.03 ft/ft downward between the B2 and B3 aquifers. The laterally continuous B-C aquitard hydraulically isolates the C and deeper aquifers from the overlying aquifers as determined for the MEW region by others (Harding Lawson Associates 1987).

Horizontal hydraulic conductivity in the aquifers in the MEW region ranges from 1E-04 to 8E-01 centimeters per second (cm/sec). An average transmissivity value for the A aquifer based on pumping tests at the site was 1,000 gallons per day per foot (gpd/ft), or 1 centimeter square per second. Slug tests performed for wells NEC3A, NEC4A, and NEC12A indicated hydraulic conductivity values of 8E-03, 2E-03, and 3E-04 cm/sec, respectively. The range of vertical hydraulic conductivity in the aquitards in the MEW region is from 2E-09 to 1E-04 cm/sec.

The average horizontal hydraulic gradient in the A and B1 aquifers at the 501 Ellis Street site, as determined in February 1991, was 0.002 and 0.001, respectively. Based on a hydraulic conductivity of 8E-03 cm/sec, a gradient of 0.002, and effective porosity of 0.25, average seepage velocity in the A1 aquifer was calculated to be 66 feet per year.

The water table at the 501 Ellis Street site has fluctuated due to seasonal variations and drought conditions. During drought conditions prior to 1991, the depth to groundwater in the A aquifer ranged from approximately 14 to 25 feet below ground surface (bgs).

More Recent Hydrogeologic Data

The average vertical hydraulic gradient at the site as calculated from May 25, 1995 data is 0.08 ft/ft and 0.26 ft/ft upward from the B1 to the A aquifer and B2 to B1 aquifer, respectively; and is 0.015 ft/ft downward between the B2 and B3 aquifers. The average vertical hydraulic gradients in the A and B aquifer pairs for water level measurements taken on May 25, 1995 are provided in Table 2-1.

The water table at the site has fluctuated due to seasonal variations and previous drought conditions. Water level data collected in 1992 indicated that the water table elevation increased approximately 1.4 feet from 1991. In 1993 and 1994, the water table continued to rise in the A aquifer, increasing an average of 2.8 feet and 0.98 feet, respectively. Similar trends have been observed throughout 1995. Currently, the water level in the A aquifer is approximately 9 to 11 feet bgs.

The horizontal hydraulic gradient in the A aquifer at the 501 Ellis Street site using May 1995 water level data averages 0.008. The May 1995 groundwater elevation contours for the A aquifer in the MEW area are shown in Figure 2-1. Elevation contours in the vicinity of 501 Ellis Street and based on more recent data are depicted on Figure 2-2. The primary direction of groundwater flow in the A aquifer around the 501 Ellis Street building is to the north. Using the May 1995 data, the average seepage velocity in the A aquifer is 160 feet per year.

As proposed in the Preliminary Design, an aquifer pumping test was conducted on well NEC22A in March 1996 to determine aquifer characteristics, and refine the number and placement of extraction wells in support of the SCGWR design. An additional pumping test was conducted on well NEC12A to yield additional data on the eastern portion of the 501 Ellis Street property. Results of the two tests confirmed low transmissivity in a heterogenous A aquifer. NEC22A yielded transmissivity values of 35 square feet per day (ft²/day) and 21 ft²/day for pumping rates of 2 and 3 gallons per minute, respectively. Transmissivity at NEC12A was determined to be 6.5 ft²/day. The tests indicated low permeability boundary effects as the cone of depression

expanded away from the pumping well. Analysis of the data concluded that a spacing between the extraction wells of approximately 130 feet will optimize the expected capture zone of each well and provide effective hydraulic control of the site. A complete report of the pumping test and analysis of data is provided as Appendix A.

2.2.3 Groundwater Quality

Groundwater quality data from sampling performed prior to 1991 and from more recent groundwater monitoring are briefly discussed below.

Findings Prior to 1991

Groundwater in the MEW region contains high levels of major inorganic ions, total dissolved solids, and coliform bacteria in the A and B aquifers, and total coliform bacteria in the C aquifer, which limits the use of groundwater in the region without prior treatment. However, the groundwater quality does meet the state's definition of a potential drinking water source.

The VOCs detected in groundwater samples collected at the 501 Ellis Street site include trichloroethene (TCE), 1,1,1-trichloroethane (1,1,1-TCA), Freon 113 (1,1,2-trichloro-1,2,2-trifluroethane), cis- and trans-1,2-dichloroethene (DCE), 1,1-dichloroethane, 1,1-dichloroethene, chloroform, and tetrachloroethene (PCE). Of these chemicals, TCE has been detected most frequently and at the highest concentrations (150 micrograms per liter (µg/L) in NEC8A to 2,400 µg/L in NEC1A). The remaining VOCs represent only a small fraction of the total chemicals detected in groundwater.

The higher concentrations of VOCs in groundwater found at the southeast corner of the building are consistent with VOCs found historically in soil in this area. Soil above cleanup standards was remediated in this area during the 1991 soil remediation. Additional information regarding the vadose zone remediation can be found in the Soil Remediation Report for 501 Ellis Street (Bechtel 1992a) and Addendum 1 to the report (Bechtel 1995b).

Recent Groundwater Data

TCE concentrations detected in groundwater at the site have remained fairly constant over the past two years of monitoring (1993 through 1995). Table 2-2 presents the TCE concentrations detected in groundwater samples prior to and subsequent to soil remediation activities.

Thirteen wells screened in the shallow A aquifer have been sampled as part of the 501 Ellis Street site groundwater monitoring program. Table 2-3 shows the groundwater monitoring results for these 13 wells for the most recent quarterly groundwater sampling round (July 1995). TCE iso-concentrations are plotted on Figure 2-3. The July 1995 data indicate that only five VOCs (acetone, cis-1,2-dichloroethene, trans-1,2-dichloroethene, TCE, and Freon-113) were detected in samples collected from wells screened in the A aquifer, although acetone is believed to be a laboratory contaminant. TCE was detected in 11 of the 13 wells (85 percent) at concentrations ranging from 43 µg/L (NEC8A) to 1,700 µg/L (NEC1A). With the exception of cis-1,2-DCE, all other compounds detected were below their respective maximum contaminant levels (MCLs). Elevated TCE concentrations observed in the western portion of 501 Ellis property (in wells NEC7A and NEC23A) are believed to be unrelated to the 501 Ellis Street site. These results are consistent with the previous nine rounds (post-remediation groundwater samples).

Similar to the MEW Area, TCE has been demonstrated as the predominant chemical found in groundwater at the 501 Ellis Street site. Therefore, it serves as an appropriate broad indicator of the size and extent of contamination, and the effectiveness of the remedial system for the site. The ratio of TCE to other chemicals found in groundwater at the 501 Ellis Street site, and its concentration with respect to the MCL, is high enough such that when TCE is reduced to the cleanup level, it is assumed that the other chemicals will be reduced to concentrations that meet ARARs and do not exceed maximum cumulative risk levels. Consequently, a decline in TCE concentrations during groundwater remediation should be indicative of a decrease in levels of any other contaminants. However, as stated in the Explanation of Significant Difference (EPA 1990), the cleanup standards for all chemicals of concern, regardless of the TCE level, will be used to monitor progress of the remedial effort.

SCGWR Final Design

This section provides an overview of the SCGWR system for 501 Ellis Street. It includes descriptions of the applicable design criteria and design parameters for the extraction, conveyance, and treatment systems.

3.1 DESIGN BASIS

As described in Section 1, the goal of the SCGWR system is to address elevated VOC concentrations in groundwater beneath the 501 Ellis Street site. The SCGWR Final Design proposes that groundwater be extracted, conveyed, treated by a granular activated carbon (GAC) adsorption system, and discharged to the City of Mountain View's publicly owned treatment works (POTW). Design of this system is based on specific criteria developed from data generated from numerous geological and hydrogeological investigations conducted at the site and in the general MEW Area. Incorporation of these criteria into the Final Design are discussed below.

3.1.1 Influent Flow Rates

Results of recently-conducted aquifer pumping tests at monitoring wells NEC22A and NEC12A indicate long-term extraction rates of approximately 0.5 gallons per minute (gpm). Based upon these results and the geological similarities among aquifer materials at the site, it is likely that the average long-term extraction rate for each of the proposed extraction wells would also be on the order of 0.5 gpm. In addition, the tests indicated low permeability boundary effects as the cone of depression expanded away from the pumping well. Analysis of the data concluded that a spacing of approximately 130 feet between the extraction wells will optimize the expected capture zone of each well and provide effective hydraulic control of the site. This results in an extraction well network consisting of three wells: NEC1AE, NEC22AE, and NEC27AE, pumping a total rate of 1.5 gpm. Locations of the wells are shown in Figure 3-1.

After the treatment plant is operational a field test will be conducted to verify that three extraction wells are providing hydraulic control of the site. If three extraction wells do not provide hydraulic control additional wells or other alternatives will be considered to remediate the plume. The verification test will be an Operation and Maintenance Plan (O&MP) activity.

3.1.2 Influent Concentrations

As discussed in Section 2, TCE is the predominant chemical in groundwater at the 501 Ellis Street site, and therefore serves as an appropriate indicator compound for VOCs during design of the SCGWR system. Determination of influent VOC concentrations to the groundwater treatment system are based on estimates of expected TCE concentrations for individual extraction wells. Analytical data from selected monitoring wells adjacent or nearby to the proposed extraction wells were used to estimate these TCE concentrations.

During the period 1994 to 1995, concentrations of TCE at monitoring well NEC1A, which is adjacent to extraction well NEC1AE, averaged 1,620 μ g/L. Total VOC concentrations (including TCE) averaged 1,680 μ g/L. TCE represents 96 percent of the total VOC concentrations.

Concentrations of TCE at monitoring well NEC22A, which is proposed to be converted into extraction well NEC22AE, averaged 320 μ g/L. TCE concentrations at NEC22A represent approximately 89 percent of the averaged total VOC concentrations (360 μ g/L).

Four monitoring wells are adjacent to the proposed location of extraction well NEC27AE: NEC7A, NEC23A, and NEC24A to the south, and NEC8A to the east of NEC27AE. The TCE concentrations in the four monitoring wells averaged 110 μ g/L from 1994 to 1995. The average TCE concentration increases to 135 μ g/L without including NEC8A. The highest average TCE concentration detected during the two year period was from well NEC23A at 210 μ g/L.

Design influent concentration to the groundwater treatment plant was calculated using average concentrations from monitoring wells NEC1A, NEC22A, and NEC23A to represent extraction well concentrations. Data from NEC23A were used because it is closest to NEC27AE and also exhibits the highest VOC and TCE concentrations of the four wells in the immediate area. Using an approximate flow rate of 0.5 gpm from each extraction well and estimated TCE concentrations of 1,620 μ g/L, 320 μ g/L, and 210 μ g/L from wells NEC1AE, NEC22AE, and NEC27AE, respectively, the design concentration of TCE entering the groundwater treatment plant was calculated to be on the order of 720 μ g/L. Similarly, using the total VOC concentrations of 1,680 μ g/L, 360 μ g/L, and 220 μ g/L for the three wells resulted in an influent concentration of approximately 750 μ g/L.

3.1.3 Effluent Concentrations

The SCGWR Final Design proposes the discharge of treated groundwater into the City of Mountain View POTW as the preferred method of disposal. Therefore, the SCGWR treatment plant has been designed to meet all discharge requirements under the City of Mountain View's Liquid Waste Discharge Permit. Under the current standards, single VOC concentrations may not exceed 750 µg/L and total VOC concentrations may not exceed 1,000 µg/L. However, if discharge to the POTW is not possible or the permit is discontinued, discharge of the treated groundwater will be subject to the requirements of the National Pollutant Discharge Elimination System (NPDES) general permit. The NPDES general permit imposes additional limits for selected organics and inorganics which must be attained. Design of the SCGWR treatment plant has included provisions to meet these alternative requirements.

A groundwater reuse assessment was presented in the SCGWR Preliminary Design and has been re-evaluated during the Final Design. However, due to the low volume of treated water available and the disinterest of potential users, reuse of the treated groundwater remains an impractical disposal option for the SCGWR system.

3.2 SCGWR PROCESS DESCRIPTION

The proposed SCGWR Final Design process consists of groundwater extraction, treatment by activated carbon adsorption, and discharge to the POTW. Groundwater will be extracted from three wells screened in the A aquifer, and will be conveyed in a buried double-containment piping system to the groundwater treatment plant located in the northeast corner of the 501 Ellis Street site. Major process equipment includes: a holding tank; a carbon adsorber feed pump; a cartridge filter; and three granular activated carbon (GAC) adsorbers operating in series. The major process equipment is shown in the piping and instrumentation diagram (P&ID), see drawing M-001 in Appendix B. Associated equipment includes connecting piping, sump pump, flow meters, well head assembly, leak detection systems, and electrical and control systems. The groundwater treatment plant will be located on a bermed concrete pad, enclosed by a chain link fence with redwood slats and a roof.

The Final Design includes a holding tank to collect groundwater from the three wells prior to treatment. The holding tank and associated carbon adsorber feed pump will ensure that the hydraulic capacity of the carbon adsorbers (10 gpm) is not exceeded by the extraction well

pumps. The carbon adsorber feed pump will pump groundwater through the cartridge filter to remove suspended solids, and through the carbon adsorbers for the removal of organics, and into an on-site sanitary sewer access. Treated water will be conveyed via the on-site sanitary sewer to the City of Mountain View POTW.

3.3 DESIGN CRITERIA

3.3.1 Applicable Codes and Standards

The SCGWR system includes the installation/conversion of groundwater extraction wells; installation of groundwater conveyance piping; construction of a groundwater treatment plant; and installation of electrical and control systems. The applicable codes and standards for the civil, mechanical, and electrical components include:

Civil

- American Concrete Institute (ACI)
- American Society for Testing and Materials (ASTM)
- Concrete Reinforcing Steel Institute (CRSI)
- Uniform Building Code (UBC)
- City of Mountain View Requirements

Mechanical

- American National Standard Institute (ANSI)
- American Petroleum Institute (API)
- American Society of Mechanical Engineers (ASME)
- American Society for Testing and Materials (ASTM)
- American Welding Society (AWS)
- City of Mountain View Requirements
- Occupational Safety and Health Administration (OSHA)

Electrical and Control

- City of Mountain View Requirements
- Institute of Electrical and Electronic Engineers (IEEE)
- Instrument Society of America (ISA)
- National Electrical Code (NEC)
- National Electrical Manufacturer's Association (NEMA)
- National Fire Protection Association (NFPA)
- Underwriter's Laboratories, Inc. (UL)

3.3.2 Major Equipment

This section presents the major equipment in the SCGWR Final Design. Additional design information is provided in Sections 3.5, 3.6, and 3.7. A more detailed equipment list is contained in Appendix C.

New Extraction Wells (NEC1AE and NEC27AE)

Extraction Well:

6-inch diameter

• Well Screen:

NEC1AE stainless steel, NEC27AE PVC, 0.020 inch,

continuous wire-wrapped

· Casing:

Riser casing with vented cap, polyvinyl chloride (PVC)

threaded flush joints

Filter Pack:

Monterey No. 3 sand filter pack

Annular Seal:

Bentonite chips or pellets

Backfill Material:

Cement-bentonite grout

Existing Extraction Well (NEC22AE)

• Extraction Well:

4-inch diameter

· Casing:

Polyvinyl chloride (PVC), Schedule 40

Extraction Well Pumps (P-101, P-102, and P-103)

• Pump type:

Submersible

Motor:

1/3 Horsepower

• Pump material:

Stainless steel

• Flow rates:

3.5 gpm design, 0.5 gpm average each

Holding Tank (TK-210)

• Diameter:

5 feet

Height:

6 feet

Material:

Carbon steel with Plasite lining

Carbon Adsorber Feed Pump (P-202)

• Pump type:

Horizontal Centrifugal

Motor:

1 Horsepower

Pump material:

Casing - Cast iron, impeller - stainless steel

Flow rate:

10 gpm design, 1.5 gpm average

Cartridge Filter (CF-201)

Flow rate:

10 gpm design, 1.5 gpm average

• Pressure Rating:

150 pounds per square inch gauge (psig)

Cartridge size

20 microns

Activated Carbon Adsorbers (GAC-201, GAC-202, and GAC-203)

• Flow rate:

10 gpm design, 0.5 gpm average

• Design pressure:

15 psig

• Vessel size:

2 feet diameter, 3 feet shell height (55 gallon canister)

GAC fill:

165 pounds/vessel

• Empty Bed

Contact Time:

5 minutes per canister

Operation:

3 vessels in series

Conveyance Piping

• Flow rate:

10 gpm design, 0.5 gpm average

• Design pressure:

150 psig

Material:

High density polyethylene (HDPE)

Influent line:

Double containment with a 1-inch diameter carrier pipe and 3-inch

diameter containment pipe

• Effluent line:

1-1/2-inch diameter piping

3.4 EXTRACTION WELL DESIGN

Three extraction wells are proposed for the 501 Ellis Street site. Two new wells, designated as NEC1AE and NEC27AE, will be drilled and completed with a 6-inch diameter casings. Extraction wells will be constructed with PVC casings. An existing monitoring well, NEC22A, with a 4-inch PVC casing will be converted into an extraction well, which will be designated as NEC22AE.

3.4.1 Location

The locations of the proposed extraction wells, NEC1AE, NEC22AE, and NEC27AE, are shown in Figure 3-1 and Drawing C-001 in Appendix B. Extraction well NEC1AE will be constructed in the area of highest TCE concentration at the site, at the southeastern portion of the 501 Ellis Street building. Extraction well NEC22AE is located directly downgradient of NEC1AE and will intercept groundwater between NEC1AE and the north edge of the building. Extraction well NEC27AE will be located in the northwest corner of property and will intercept groundwater with elevated concentrations of TCE. Based on lithology observed in nearby wells, NEC27AE should intercept the A zone at depths ranging from 15 to 20 feet below ground surface (bgs). Estimated hydraulic capture zones for these wells, based on results of the recent aquifer tests, are depicted in Figure 3-1.

3.4.2 Pumping Rate

The average pumping rate per well, as described in Section 3.1.1, will be approximately 0.5 gpm. This rate was determined from the recent aquifer tests and is discussed in greater detail in Appendix A, Aquifer Test Results.

3.4.3 Well Construction Design

Based on borings logged for 13 monitoring wells at the site, the most permeable zone within the unconfined A aquifer typically ranges from 15 to 23 feet in elevation. The permeable zone consists of gravely sand, sand, and silty sand strata with less permeable interbeds of clay, silty clay, and clayey silt.

The well construction design of NEC1AE was based on the hydrogeology of the A aquifer near the well location, as determined by continuous samples from boring S-03, located approximately 15 feet southwest of NEC1A. Field modification of the well design of NEC1AE and NEC27AE may be necessary based on observation of the aquifer formation during the drilling of the borings and the subsequent preparation of a geologic log by the hydrogeologist. The proposed construction design for NEC1AE and NEC27AE consists of a total well depth of 31 feet, sand pack up to 9 feet bgs from the bottom, and a screened interval between 14 feet and 29 feet bgs. The well construction diagram for the proposed wells, NEC1AE and NEC27AE, is shown in Figure 3-2.

Construction design of NEC22AE consists of a total well depth of 29 feet, sand pack from the bottom of the well to 23 feet bgs, and a screened interval between 25 feet and 27 feet bgs. The well construction diagram of proposed extraction well NEC22AE is shown in Figure 3-3.

3.5 GROUNDWATER EXTRACTION AND CONVEYANCE PIPING DESIGN

Major components of the groundwater extraction and conveyance piping design include the extraction well pumps, the well head vaults and instrumentation, and the groundwater collection piping. Drawing M-001 (included in Appendix B) is the piping and instrumentation diagram (P&ID) for the SCGWR treatment system.

3.5.1 Well Pumps

The extraction well pumps will be electrically powered, submersible, stainless steel pumps. The pump sizing was based on the expected flow rates and the depth of the pump in the extraction well, the distance from the extraction well to the groundwater treatment system, and the height of the holding tank. The pumps were sized to provide the required pressure needed to discharge groundwater from the low liquid level in a well to the holding tank. The pumps for NEC1AE and NEC27AE will be set at 24 feet bgs, approximately 5 feet above the bottom of the screened interval. The pump for NEC22AE will be set in the screened interval that extends from 25 feet to 27 feet bgs.

Low aquifer yields are expected, based upon the aquifer tests, and even the smallest readily available electrically powered submersible pump will likely dewater the extraction wells. Therefore, pumping of the extraction wells will be conducted intermittently.

3.5.2 Well Head Vaults and Instrumentation

Each well head will be housed in a prefabricated concrete vault to provide protection from surface traffic and to prevent surface water seepage into the well head and instrumentation. The concrete vaults will have H-20 traffic rated steel covers. The well casings will be sealed at the base of the vault to prevent seepage into the casing. The finished surface of the well head vault will be 2 to 3 inches above grade, with the pavement sloped to drain surface water away from the vault. The well head vault with piping and instrumentation is shown in Drawing M-003 in Appendix B.

Low and high liquid level sensors will be installed within the well casing to stop the pump when the water level falls below a pre-set level, and to activate the pump after the well sufficiently recharges. A pressure gauge will also be installed at the well head to monitor the discharge pressure of the extraction well.

Piping within the well head vault will consist of 1-inch diameter, Schedule 40 PVC. A sampling port, strainer, air and vacuum valve, flow meter, check valve, and ball valve will be included in the well head piping scheme. A leak detection system will be located within each well head vault to detect any leakage from the conveyance piping or flooding of the well head vault.

3.5.3 Groundwater Collection Piping

Groundwater collection piping will be a double containment system with a 1-inch diameter carrier pipe and a 3-inch diameter containment pipe. The effluent discharge pipe will be 1-1/2-inch in diameter. The collection and discharge pipes will be placed in excavated trenches and backfilled in place. HDPE was selected over PVC for the conveyance piping due to its durability.

3.5.4 Treatment Plant Piping

The piping within the treatment plant will be CPVC. The CPVC piping will be connected to the incoming and outgoing HDPE piping by flanges.

3.6 GROUNDWATER TREATMENT PLANT DESIGN

The groundwater treatment plant will be located in the northeast corner of the 501 Ellis Street site, based on the site requirements of the present property owners. The locations of the treatment plant, extraction wells, and conveyance piping route are shown in Drawing C-001 (included in Appendix B).

3.6.1 Site Plan Description

The layout of the groundwater treatment plant is shown in Drawing M-002, Appendix B. The equipment will be located within a bermed concrete pad. The berm has the capacity to contain at least 150 percent of the volume of the largest container on the pad. A chain link fence with redwood slats will surround the perimeter of the treatment plant. The space available within the concrete berms for the treatment plant equipment is 10 feet by 30 feet.

3.6.2 Major Treatment Plant Equipment

Major components of the groundwater treatment plant are the holding tank; carbon adsorber feed pump; cartridge filter; and the activated carbon adsorbers. The major components are shown in the P&ID, Drawing M-001 in Appendix B.

Holding Tank and Carbon Adsorber Feed Pump

The holding tank will collect groundwater from the three extraction wells and the carbon adsorber feed pump will pump the groundwater through the cartridge filter and activated carbon adsorbers into an on-site sanitary sewer. The holding tank and carbon adsorber feed pump control the flow to the carbon adsorbers and ensure that the maximum flow rate of the carbon adsorbers, 10 gpm, is not exceeded. Without a holding tank, the extraction well pumps would pump directly to the activated carbon adsorbers and simultaneous operation of three extraction pumps may exceed 10 gpm. In addition, the holding tank will provide a means of collecting and treating of any drainage or excess water that may accumulate in the bermed treatment area from equipment maintenance operations or incidental intrusion of rain water.

Cartridge Filter

The cartridge filter precedes the activated carbon adsorbers to prevent suspended solids from entering and clogging the adsorbers. The design flow rate for the cartridge filter is 10 gpm, cartridges have 20 micron openings, and the filter vessel is rated at 150 psig. Sampling ports placed at the influent to the activated carbon adsorbers will determine the effectiveness of the cartridge filter. Two piping connections will be placed at the cartridge filter influent and effluent to allow untreated water (i.e., monitoring well purge water) to enter the treatment system.

Activated Carbon Adsorbers

Three GAC adsorbers will operate in series at the groundwater treatment plant. Piping manifolds will be provided to allow any adsorber to be changed to a lead or lag adsorber. The manifolds will allow any adsorber to be isolated for the replacement of exhausted carbon while the other adsorbers are still operational. Each activated carbon canister will be 55 gallons in size and contain 165 pounds of activated carbon, rated for a maximum flow rate of 10 gpm. A pressure relief valve will be installed ahead of each adsorber to prevent the maximum operating pressure from exceeding 15 psig. Sampling ports will be placed on the influent pipes to the three adsorbers and on the plant effluent.

3.6.3 Instrumentation and Control Design

This section describes the instrumentation and controls for the groundwater treatment plant, which are shown in the P&ID Drawing M-001 in Appendix B. Instrumentation located within

the treatment plant includes a tank level gauge, level alarm, pump control systems, press gauge, pressure regulator, pressure differential indicator, high pressure indicators, flow meter, flow recorder and transmitter, flow totalizers, leak detection systems, and alarms. Since the treatment plant will not normally have an operator present; a remote alarm dialing monitor will be installed to notify the appropriate personnel of needed maintenance or system upset.

The groundwater flowrate from each extraction well will be measured, recorded, transmitted, and totaled separately, using separate flow meter assemblies. The extraction well flow meters will be located within the well head vaults. A fourth flow meter will be located on the treated water pipeline exiting the treatment plant. Data from this effluent flow meter will be used to calculate fees payable to the City of Mountain View POTW. A remote flow totalizer, showing the effluent flow, will be located in front of the 501 Ellis Street building for access by the City of Mountain View.

A pressure differential indicator will monitor pressure through the cartridge filter. If the pressure differential exceeds a set high point, an alarm switch will trigger the remote alarm dialing monitor, notifying the operator that the cartridge filter should be replaced.

A pressure gauge and a high pressure alarm switch will monitor the pressure prior to the activated carbon adsorbers. If the pressure exceeds a set high point, the remote alarm dialing monitor will notify the operator of the high pressure at the adsorbers.

A leak detection system will be located within the bermed area to detect leakage from the conveyance piping or flooding of the treatment plant. The leak detector will activate the remote alarm dialing monitor which will notify the operator.

3.7 SYSTEM DOWN-TIME ANALYSIS

The operation of the SCGWR system is relatively simple and no significant system down-time is expected. The extraction wells and groundwater treatment plant will operate intermittently. The extraction well pumps are designed to operate at 3.5 gpm and the treatment plant at 10 gpm. The expected average flow rate from each well is 0.5 gpm. Therefore, it is expected that the extraction wells would be operating about 14 percent (0.5 gpm/3.5 gpm) of the time and the treatment plant about 15 percent (1.5 gpm/10 gpm) of the time.

Maintenance items for process operation include cartridge filter replacement, cleaning a Y-strainer at each well head, and exchanging the activated carbon adsorbers. These operations will be performed periodically during the lifetime of the system. Replacing the cartridge filter and cleaning the Y-strainer are simple, straightforward operations and should take less than 10 minutes for each item. Because of the minimal on-line SCGWR system operation, about 15 percent of the time, the cartridge filter replacement and cleaning of the strainers should not impact the treatment system operation.

Carbon change-out will be accomplished by the replacement of the exhausted carbon adsorber 55-gallon canister with a new replacement canister. The exchanging of canisters will take approximately two hours, because the spent adsorber has to be isolated, drained, removed, and replaced. However, the piping system has been designed to allow for the replacement of one activated carbon adsorber while the other two adsorbers are on-line. Therefore, no impact is expected on the system operation. The estimated throughput capacity of each canister is expected to be between 600,000 and 700,000 gallons. Using the average flow rate of 1.5 gpm the time between canister replacement is expected to be about 280 to 320 days.

In addition to the process maintenance items, the pumps and control system instrumentation will require periodic maintenance. Normal maintenance required for pumps and the control system can be either accomplished when the treatment plant is operating or accomplished after an intermittent operation of the plant.

Site Management and Quality Assurance Plan

This section presents the project team organization; the site management; maintenance and security; and safety and health, quality assurance, and construction impact mitigation programs that will be implemented during the construction of the SCGWR system at 501 Ellis Street to meet applicable regulations and guidelines.

4.1 PROJECT ORGANIZATION

The NEC project team consists of representatives of NEC Electronics Inc.; Sheppard, Mullin, Richter, & Hampton, legal counsel to NEC; and Bechtel. The NEC project team organization and responsibilities are described in detail in the QA/QC Plan, Appendix E. The contractors that will be involved in the implementation of the SCGWR Final Design are also discussed in Appendix E.

4.2 SITE MANAGEMENT, MAINTENANCE AND SECURITY

Site management, maintenance, and security procedures described below are intended to ensure that the construction and start-up activities at the site proceed in an efficient and safe manner, and that site access is restricted to only appropriate persons. A Bechtel representative (the Site Construction Manager or designee) will be onsite during normal business hours while site activities are taking place. At least one Bechtel representative will be available on-site or on-call 24 hours per day. The Site Construction Manager or other onsite Bechtel representative (as appropriate to the activity) will be responsible for overall site management including coordination of contractors' activities, site access to visitors, requests for information, coordination with representatives from regulatory agency, and oversight of site maintenance and security.

Site maintenance will involve providing a temporary office trailer, equipment storage, utility services, and sanitation facilities; maintaining roads and fences; controlling wind-borne emissions and miscellaneous debris.

During construction activities, site security will be provided 24 hours per day. Site visitors will be restricted to qualified personnel. Site visitors will be required to sign in and receive site-specific safety and health orientation, as appropriate for the nature of their visit.

The 501 Ellis Street property is currently owned by Renault & Handley. NEC's existing access agreement with Renault and Handley will be used to obtain access to the site. During the construction of the SCGWR treatment system, the Safety and Health Officer (SHO) will coordinate access and security onsite. Work areas will be identified by one or more of the following: signs, traffic cones, and safety tape or equivalent. No unauthorized persons will be allowed within the work area, but no insurmountable barriers will prevent access to the work area.

All personnel and project-related visitors will be required to check in and out with the SHO upon entering and exiting the property. However, the SHO cannot and is not expected to keep track of the general public who may be passing near the work area. The SHO will advise nearby occupants and bystanders that hazards exist, prohibit entry into the work space, and encourage relocation of outside activities to locations as far from possible from the work area.

4.3 CONSTRUCTION IMPACT MITIGATION PROGRAM

The construction impact mitigation program consists of several elements: stormwater management, dust control, spill prevention and control, and waste management. Each of these elements is discussed below.

4.3.1 Stormwater Management

During the construction of the treatment system, stormwater will be managed by diverting runoff from construction areas in particular, where excavated materials and stockpiles are handled.. Stormwater will be diverted by sloping these areas to plastic-lined sumps for eventual pumping and discharge to the sanitary sewer system. After backfilling the excavations, the site will be graded to promote effective runoff.

4.3.2 Dust Control

Dust control measures will be implemented to prevent airborne emissions of soil containing chemicals. These measures will include spraying water on excavations, backfill and stockpile surfaces, and placing plastic over stockpiles. Airborne dust emissions will be monitored in accordance with the Safety Health and Emergency Response Plan (SHERP) (Bechtel 1991f) which will be revised and submitted to EPA as part of the Construction, Operation, and Maintenance Plan (COMP).

Dust and particulate matter will be monitored by visual observation. Quantitative monitoring of dusts and particulates in air will be performed if dusts cannot be controlled using engineering methods such as water sprays or covering. However, the soil at the site is naturally moist, and dust monitoring is not expected to be necessary.

4.3.3 Spill Prevention and Control

The primary personnel responsible for implementing spill prevention and control during construction of the groundwater extraction and treatment system are the SHO and the Site Construction Manager. The greatest potential for spills during normal operations would be from leaking or spilled containers of well purge water or petroleum products from leaking equipment or vehicles. Spilled purge water generally would not present a hazard to site personnel or the environment. Spills could also result from leaking oil, fuel, or hydraulic fluid from equipment or vehicles operating onsite. Leaks would normally be detected during routine daily inspection of equipment. The size of the spill is anticipated to be relatively small and would be limited to the size of the equipment reservoir. For relatively small releases, an absorbent will be applied to the surface of the spill and around the spill area to prevent further spread of the released material. Absorbent will be applied and reapplied until all the liquid has been absorbed.

The person who discovers the release will immediately notify the SHO. The SHO or his designee will notify the Construction Site Manager, and the Bechtel Project Manager. The SHO or his designee will remain on the scene until the area affected is secured or released, prepare a checklist showing the persons contacted and the time, monitor exposure to chemical substances, determine the need for personal protective equipment, and control access to restricted work areas and provide cleanup guidance. If a reportable quantity of a hazardous substance or a harmful quantity of oil is released, the SHO must notify the National Response Center at (800) 424-8802.

4.3.4 Waste Management

Procedures for the management of wastes generated during the source control groundwater remediation are described in the Waste Management Plan, Appendix F. The Waste Management Plan provides guidelines for the characterization, handling, storage, and disposal of wastes generated during the construction and operation of the SCGWR system. Specifically, the Waste Management Plan provides guidelines for the management of asphalt materials; excavated trench soils; drill cuttings, well development, purge, and decontamination wash water; personal protective equipment (if used); and construction waste and debris.

4.4 SAFETY AND HEALTH

The prevention of accidents that result in injury or illness to employees, interruption of work, or damage to equipment or property is of paramount concern. All reasonable action will be taken to establish, monitor, and maintain safe and healthful working conditions on this project in accordance with local, state, and federal requirements.

The SHERP provides procedures for maintaining a work environment which will not compromise the health of onsite personnel or the public. The SHERP was developed from guidelines established by NIOSH/OSHA/USCG/EPA. The plan will be revised and will be submitted as part of the COMP. The revisions will address site activities specific to the construction and operation of the groundwater treatment and extraction system.

4.5 QUALITY ASSURANCE PROGRAM

The quality assurance program consist of QA/QC activities that will be implemented during the construction of the SCGWR system and during environmental monitoring activities. (The Site Environmental Monitoring Plan is presented in Section 6).

4.5.1 Construction Quality Assurance

The construction quality assurance testing program is designed so that the construction performed during the SCGWR is in accordance with the specifications and standards, and meets the design parameters. The QA/QC Plan will be implemented through QC inspection, sampling, testing, and review of services and workmanship required under the SCGWR Final Design. The

QA/QC inspection will be performed by the designated Independent Quality Assurance Team (IQAT).

The construction QA/QC Plan will follow the procedures, guidelines, test, and inspection protocols specified in the drawings and specifications provided in Appendices B and D of this Final Design. Health and safety; earthwork, trenching and backfilling; installation and development of monitoring and extraction wells; and piping installation will be monitored under this program. The testing program for each of these activities is outlined in Appendix E, Quality Assurance/Quality Control Plan. ASTM methods, or other industry standards will be used when possible. Quality assurance testing will be documented in the field logbook and daily report forms.

4.5.2 Compliance Monitoring Quality Assurance

The compliance monitoring program will be described in detail in the Sampling and Analysis Plan (SAP). The Sampling and Analysis Plan (SAP), comprised of the Field Sampling Plan (FSP) (Bechtel, 1991e) and the Quality Assurance Project Plan (QAPjP) (Bechtel 1991d), will be revised and submitted as part of the COMP. The FSP will provide detailed information on sample collection and analysis. The FSP will address the collection and analysis of groundwater samples to monitor the performance and progress of the treatment system. The FSP will also address the collection and analysis of wastes generated during the construction and operation of the treatment system to determine their proper disposal. The QAPjP will define protocols for sample collection, transportation, chain of custody procedures and analytical methods that will ensure the integrity and validity of the analytical results.

In general, compliance monitoring will include measurement and/or sampling and analysis of:

- Wastes generated during construction activities including excavated trench soils, drill cuttings, well development and purge water decontamination fluid, personal protective equipment and construction debris;
- Wells included in the groundwater monitoring network to monitor the progress of the treatment system;

- Water levels to verify the capture of the treatment system (along with extraction well drawdown data and pumping rates);
- Treatment system effluent to verify that discharge requirements are being met; and
- Imported backfill materials to confirm the absence of VOCs.

Compliance monitoring data will be evaluated according to the procedures specified in the QAPiP to be submitted as part of the COMP.

4.5.3 Safety and Health Monitoring Quality Assurance

QA/QC protocols that will be implemented to monitor safety and health activities are described in the QA/QC Plan, Appendix E.

Attainment of ARARs, Permits, and Performance Standards

Section XVII.A of the §106 Order requires that all work performed shall comply with the ARARs identified in the Record of Decision (ROD). ARARs identified for the SCGWR Final Design are classified into chemical-specific, action-specific, or location-specific catagories as they relate to the construction and operation of the proposed source control groundwater remedation system. All activities must be performed in accordance with the requirements of all applicable federal, state, and local laws, regulations, and permitting requirements. Completed permit applications are included in Appendix G and a summary of permits is presented in Table 5-1.

This section describes how the proposed groundwater extraction and treatment system will comply with applicable performance standards for site-specific source control at 501 Ellis Street. Effective operation of the SCGWR system will result in the attainment of required performance standards.

5.1 CHEMICAL-SPECIFIC ARARS

Chemical-specific ARARs are generally human-health or risk-based numerical values or methodologies applied to site-specific conditions that result in establishing numerical cleanup values.

CERCLA Section 121(d)(2)(A)(ii) states that MCLs, as promulgated under the Federal Safe Drinking Water Act (SDWA), are applicable requirements in determining cleanup standards for groundwater at CERCLA sites. The ROD determined that federal MCLs would be used as the cleanup standards. MCLs promulgated by California under SDWA authority also are applicable requirements. Some of the California MCLs are more restrictive than federal MCLs. As stated in the §106 Order, the ROD, and the Explanation of Significant Differences (ESD), chemical-specific ARARs for this site are federal and State of California drinking water standards.

The cleanup level for TCE designated in the \$106 Order is 5 μ g/L for groundwater in the A aquifer and B aquifer, and 0.8 μ g/L in the C Aquifer and Deep Aquifer. According to the \$106 Order, it is expected that the remedy designed to achieve TCE cleanup standards will also result in the cleanup of the other site VOCs and that the resulting concentrations of VOCs will meet ARARs and will not exceed maximum cumulative risk levels. Table 5-2 presents the organic

chemicals of concern (COCs) stated in the §106 Order and lists their associated MCLs from the ROD.

The regional groundwater remediation program for the MEW Area is expected to continue until ARARs are attained and applicable clean-up levels are met. The source control groundwater remediation described in this document is intended to complement the regional system. The monitoring program described in Section 6 is designed to assess the effectiveness of the SCGWR system at 501 Ellis Street independently and relative to the regional system.

5.2 ACTION-SPECIFIC ARARS

Action-specific ARARs include those pertaining to construction and operation of the groundwater extraction and treatment system, operation and installation of the system components, and handling and disposal of treated water and activated carbon.

5.2.1 Construction of Groundwater Treatment System and Conveyance Piping

The California Occupational Safety and Health Administration (Cal-OSHA) requires a valid excavation permit if excavation or trenching activities occur at depths exceeding 5 feet bgs. However, since excavation for the SCGWR system at 501 Ellis Street site is not expected to exceed a depth of 4 feet bgs, this requirement is not applicable. Nevertheless, all trenching and excavations will be conducted in accordance with applicable Cal-OSHA regulations.

Vadose zone soil containing VOCs above applicable cleanup standards were excavated and remediated in 1991. Thus, soil excavated from trenching activities are not anticipated to contain VOCs above cleanup standards. However, as a conservative measure, samples of excavated soils will be collected and analyzed for confirmation and to establish profile information for disposal. Excavated soils will be classified in accordance with California Code of Regulations, Title 22 (22 CCR), Division 4.5, Chapter 11 (Identification and Listing of Hazardous Waste): In the unlikely event that the soils are classified as hazardous, they will be managed according to the applicable generator standards of 22 CCR, Division 4.5, Chapter 12 (Standards Applicable to Generators of Hazardous Waste).

5.2.2 Extraction Well Construction and Installation

The construction and installation of extraction wells NEC1AE and NEC27AE, construction of additional monitoring wells (if necessary), and the modification of existing monitoring well NEC22A will be completed in accordance with the requirements of the Santa Clara Valley Water District (SCVWD). Well construction permits will need to be obtained from the SCVWD prior to starting work. Completed applications are included in Appendix G, and will be submitted following approval of the final design. The new extraction wells NEC1AE and NEC27AE will be constructed in compliance with the conditions of the permit and the SCVWD's Ordinance 90-1, An Ordinance of Santa Clara Valley Water District Regulating the Classification, Construction and Destruction of Wells and Other Deep Excavations; Requiring the Destruction of Abandoned or Unused Wells; Adopting Water Contamination Hazard Standards; Making a Violation a Misdemeanor; and Repealing Ordinance No. 85-1. General conditions of the well installation permit include the following:

- The SCVWD Well Inspection Department must be notified at least 24 hours prior to sealing the annular space so that a District Inspector can be on-site to witness the sealing;
- The well installation contractor must be a licensed C-57 water well drilling contractor:
- Work authorized by the permit shall begin within 180 days from the date of issuance of the permit unless a different starting date is stated in the permit; and
- The water well driller is to complete the California State Department of Water Resources Form 188 (Well Completion Report) and mail the original to the SCVWD within 30 days of well construction completion.

In addition to the above requirements, the SCVWD has requested that a notification letter describing the flow rate and point of measurement be submitted prior to or after modification of well NEC22A.

Since drill cuttings from installation of the new wells may contain elevated concentrations of VOCs, they will be placed in separate containers as generated and analyzed for constituents of concern. The cuttings will be classified in accordance with 22 CCR, Division 4.5, Chapter 11 (Identification and Listing of Hazardous Waste). If determined to be hazardous, they will be

managed according to the applicable generator standards of 22 CCR, Division 4.5, Chapter 12 (Standards Applicable to Generators of Hazardous Waste). Procedures for handling and managing wastes generated during the construction of the treatment system are provided in the Waste Management Plan, Appendix F.

5.2.3 Groundwater Treatment and Discharge

Since extracted groundwater will contain VOCs, appropriate conveyance and containment structures have been designed to prevent any release of groundwater to the environment. Conveyance piping will be double-contained with a leak detection system at the extraction well vaults and at the groundwater treatment plant. The groundwater treatment units consist of a holding tank, cartridge filter, granular activated carbon canisters, and associated piping and instrumentation. The treatment area will be covered by a roof, bermed, and surrounded by an 8-foot high fence.

Groundwater from the extraction well system will be collected into temporary holding tank prior to treatment. The tank presents a potential source of VOC emissions during operation as the level of water flucuates within the tank. However, since concentrations will not exceed 1 percent organic compounds (highest groundwater concentration at the site is approximately 2,000 μ g/L), the tank is exempt from the Bay Area Air Quality Management District (BAAQMD) regulations under Regulation 2, Rule 1, Section 123.

Use of granular activated carbon for remediation of VOCs can trigger requirements associated with off-site regeneration and disposal of the spent carbon. Spent carbon regeneration will comply with the requirements of: 22 CCR, Division 4.5, Chapters 12 and 18; and 49 CFR 100-177 (DOT Regulations). Spent carbon that is determined to be hazardous (Resource Conservation and Recovery Act [RCRA] or non-RCRA) will be stored and transported to a recycler in accordance with federal and state requirements.

Discharge of treated groundwater to the local POTW requires compliance with the City of Mountain View's Industrial Waste Ordinance and the Clean Water Act Pretreatment Standards. The City's Ordinance sets forth effluent quantity and discharge concentration limits, along with standards for monitoring and reporting. NEC currently holds a permit for the discharge of purged groundwater to the city sewer. An amendment to the permit is being proposed to allow

continuous discharge of treated groundwater from the SCGWR system. A completed application is provided in Appendix G. Under current standards, permissible constituent discharge concentrations may not exceed a total concentration of 1,000 μ g/L for all organic solvents and may not exceed 750 μ g/L for a single constituent.

In the event that discharge to the POTW is not possible or the permit is discontinued, discharge of the treated groundwater will be subject to the requirements of the NPDES general permit. The NPDES general permit (RWQCB Order No. 94-087, NPDES No. CAG912003, July 20, 1994) regulates discharge and/or reuse of extracted and treated groundwater resulting from the cleanup of groundwater containing VOCs. The effluent limitations for the NPDES general permit include instantaneous maximum limits for selected organics and inorganics, as shown on Table 5-3. The SCGWR treatment plant will meet the NPDES general permit requirements for organics. The SCGWR treatment plant does not specifically include components designed to address inorganics that the limited analytical data indicate may be present in groundwater at the 501 Ellis Street site. The cartridge filter and GAC adsorbers should provide sufficient treatment of the inorganics that may be present in concentrations exceeding the NPDES general permit discharge requirements. If treated groundwater is to be discharged under the NPDES general permit, additional analysis of the inorganics will be conducted. Furthermore, the current SCGWR treatment plant area is designed to accommodate additional treatment equipment that may be necessary to treat inorganic constituents.

5.2.4 Off-site Disposal of Excavated Soils

Following classification as described above, the excavated trench soil and drill cuttings will be disposed of off-site. If the soils are classified as hazardous, they will be disposed of in accordance with the following regulations: 22 CCR, Division 4.5, Chapter 12 and Chapter 18 (Land Disposal Restrictions); and 49 CFR 100 through 177 (Department of Transportation Regulations).

If the soils are classified as non-hazardous, they will be disposed of in accordance with the following regulations: 23 CCR, Division 3, Chapter 15 and 49 CFR 100 through 177.

5.3 LOCATION-SPECIFIC ARARS

Prior ARAR reviews presented in the §106 Order have not identified any location-specific ARARs for the selected remedy. Local permits issued by the City of Mountain View (see Table 5-2) are required and are discussed in the following section.

5.4 OTHER PERMITS AND REQUIREMENTS

5.4.1 California Safe Drinking Water and Toxic Enforcement Act

Proposition 65, the California Safe Drinking Water and Toxic Enforcement Act of 1986 (22 CCR, Division 2, Chapter 3), requires that warning notifications be posted in areas that contain chemicals known to cause cancer or reproductive toxicity. Some of the chemicals identified in groundwater at the 501 Ellis Street site are known or suspected to be carcinogenic. Appropriate warning signs will be posted if worker exposure during remedial construction activities is possible.

5.4.2 City of Mountain View Building Permit

The City of Mountain View Planning Department requires that a zoning permit be obtained for new construction, external modifications to existing buildings, and site plan modifications. The permit applications are subject to two types of review: the Site Plan and Architectural Review (SPAR) and Zoning Administrator (ZA) review. The SPAR process focuses primarily on-site planning issues and the architectural character or proposed additions. The ZA process focuses primarily on use issues and the recommendations of the SPAR Committee. Upon submitting the application materials with the City of Mountain View Planning Department, the project will be scheduled for the appropriate SPAR and/or ZA public hearings. SPAR hearings are held on alternate Thursdays and ZA hearings are held on the first and third Tuesdays of each month. If both the SPAR and ZA reviews are necessary for the project, the ZA is the final approval body that issues the zoning permit. Once the zoning permit is issued and a 10-day appeal period lapses, building permit applications are filed. A completed application is included in Appendix G. Preliminary discussions with the City have been established.

5.5 PERFORMANCE STANDARDS FOR GROUNDWATER

The goal of the activities proposed in the SCGWR Final Design is to address elevated VOC concentrations in groundwater beneath the 501 Ellis Street site. As described in this document, the configuration of extraction wells and pumping rates are designed to provide suitable hydraulic capture of the area and source control. Performance standards applicable to the SCGWR system are based on its effectiveness as a source control measure in hydraulically controlling the area and attenuating groundwater contamination. These performance standards will be used to monitor progress of the source control activity and determine completion or attainment, or indicate if additional response activities are necessary.

5.5.1 Demonstration of Compliance

Groundwater elevation measurements and water quality data will be collected from a network of monitoring wells in order to evaluate the effectiveness of the groundwater treatment system and measure attainment of performance standards. The water level data, taken from 13 on-site and off-site monitoring wells and the three extraction wells, will be used to determine if the extraction system is providing sufficient containment of groundwater plume in the A aquifer. Potentiometric maps generated from the data will illustrate the actual extent of the system's hydraulic capture zone.

Analytical data, collected from on-site and off-site wells, and collected from the influent stream to the groundwater treatment unit, will demonstrate the progress of remediation, as decreasing concentration trends are observed. Immediate reductions in downgradient VOC concentrations are not anticipated due to the presence of residual contamination just beyond the influence of the extraction system. Slow groundwater movement and tight aquifer formations will likely exacerbate this condition. Attainment of performance standards will be more appropriately determined based on declining trends in groundwater concentrations near the source area over time.

Additional information on the groundwater elevation and water quality well networks, including frequency of monitoring, can be found in Section 6. Detailed descriptions of sample collection procedures, analytical program, and data management will be provided in the QAPjP which will be submitted as part of the COMP.

Site Environmental Monitoring Plan

This section provides a Site Environmental Monitoring Plan (SEMP) as part of the Source Control Groundwater Remediation Final Design package for the 501 Ellis Street property. The SEMP establishes the basis for an environmental data collection program to determine effectiveness of the SCGWR system. The SEMP includes rationale for selection of appropriate monitoring points and monitoring frequencies to ensure sufficient data are collected to meet the objectives of the monitoring program. Detailed descriptions regarding sample collection procedures, analytical program, data management, and other routine standard operating procedures will be provided in the Quality Assurance Project Plan (QAPjP) to be submitted as part of the COMP.

6.1 MONITORING WELL NETWORKS

The objectives of the SEMP are 1) to verify attainment of the proposed hydraulic capture zone at the site, and 2) to demonstrate the effectiveness of the SCGWR system in attainment of performance standards. Although the two data objectives share some similarities, separate monitoring networks are proposed for collection of water level data and analytical data to allow further refinement of each network, as additional data are evaluated.

6.2 HYDRAULIC CONTAINMENT NETWORK

Groundwater levels will be routinely measured in on-site and off-site wells to verify adequate hydraulic control by the SCGWR extraction system at the site. The water-level monitoring network will consist of 12 on-site A-aquifer monitoring wells (NEC1A, NEC3A, NEC7A, NEC8A, NEC9A, NEC11A, NEC12A, NEC21A, NEC23A, NEC24A, NEC25A, and NEC26A). A background well (NEC20A) will also be monitored to determine static conditions of the general area (access to this offsite well is discussed in Appendix H). In addition, drawdown and pumping rates from the three proposed extraction wells (NEC1AE, NEC22AE, and NEC27AE) will be recorded. As shown in Figure 6-1, the configuration of this monitoring network provides sufficient areal coverage of the anticipated capture zone, as well as the entire 501 Ellis Street site. Well construction information such as screen intervals and casing diameters are presented in Table 6-1. For long term monitoring of the extraction system, groundwater level measurements will be taken on a quarterly basis and will probably coincide with the MEW regional groundwater monitoring program. However, during the initial startup and during periodic adjustments/maintenance, measurements will probably be taken more frequently in order to

confirm hydraulic capture. After hydraulic conditions stabilize, water levels will be measured at a frequency of no less than quarterly.

6.3 GROUNDWATER QUALITY NETWORK

The proposed monitoring well sampling network to evaluate groundwater quality will consist of a selected subset of wells from the water-level monitoring network. Upgradient well NEC20A will provide data on groundwater quality in the A aquifer entering the site. Onsite wells NEC3A, NEC8A, NEC9A, NEC21A, NEC24A, NEC25A, and NEC26A; crossgradient wells NEC7A, NEC12A, NEC23A; and extraction wells NEC1AE, NEC22AE, and NEC27AE will be monitored to assess the effectiveness of the SCGWR system. NEC1A will also be incorporated into the sampling network; however, its structural durability is questionable due to increasing distortion of the well casing. If, at any time, well casing failure is indicated, NEC1A will be abandoned according to the Santa Clara Valley Water District guidelines. At that time, the need for a replacement monitoring well will be assessed.

Data quality objectives of the water quality monitoring program will be reviewed after the first year of sampling and periodically reviewed thereafter. Retainment or elimination of wells providing redundant or unnecessary data will be evaluated. The proposed monitoring well sampling network is shown on Figure 6-1. Anticipated hydraulic capture zones are shown on Figure 3-1. Screen intervals are presented in Table 6-1.

Routine sampling and analysis of the water quality monitoring network will provide the necessary data to evaluate the effectiveness in attaining performance standards. Startup sampling of the monitoring well network and SCGWR treatment system will occur monthly during the first three months of operation, followed by semi-annual monitoring for two years. After the first two years of operation, the monitoring network will be sampled on an annual basis. Sampling will continue on an annual basis until TCE concentrations stabilize. After the annual TCE concentrations have stabilized a reduction in the frequency of sampling (for example once in five years) will be proposed to the EPA and would be implemented if the EPA approves. It should be noted, however, that changes in groundwater conditions or any apparent data gaps may warrant more frequent sampling of the wells. Sampling frequency for the treatment system effluent will be determined based on the requirements of the discharge permit. A treatment system effluent sample will also be taken when the monitoring network is sampled.

6.4 ANALYTICAL PROGRAM

Water samples collected from the water quality monitoring network and samples from the influent and effluent streams of the SCGWR treatment system will be analyzed for halogenated volatile organics by EPA Method 8010. Effluent samples will also be analyzed for aromatic volatile organics by EPA Method 8020 following the monitoring requirements for the City of Mountain View Liquid Waste Discharge Permit. Specific chemical parameters for both analytical methods and approximate detection limits are presented in Tables 6-2 and 6-3. Detailed procedures regarding sample collection and analysis, including applicable quality controls, will be addressed in the QAPjP, to be provided as part of the COMP. Additional monitoring parameters (e.g., inorganics) may be required if the treatment water is to be discharged under a NPDES Permit. The monitoring and analysis program will assess whether the contaminant plume is being captured, whether the contaminant concentrations are decreasing with time, and when source control is achieved.

6.5 DATA EVALUATION AND REPORTING

Analytical data and water level data from the monitoring well network and analytical data from sampling of influent and effluent streams of the treatment system will be evaluated according to the QAPjP, to be provided as part of the COMP, and MEW QAPjP (Canonie 1991, 1992). The overall objective of the QAPjP is to ensure that the data collected are precise, accurate, complete, comparable, and representative. Data evaluation guidelines to assess system performance and attainment of specific system goals, and any necessary corrective actions will be presented in the QAPjP.

Following the evaluation process, generated data and interpretation of results will be routinely presented in the quarterly and annual progress reports. Results of quality assurance/control samples and other activities will be discussed in the quarterly quality assurance reports.

Schedule

Figure 7-1 presents the project schedule that outlines the major tasks and proposed start and finish dates. The proposed schedule is in accordance with the requirements of the §106 Order. The proposed schedule begins with the submittal of the SCGWR Final Design Package and finishes with the implementation of the SCGWR system. The project schedule was developed with the assumption that each deliverable would undergo a 90-day review and approval cycle, which includes 45 days for EPA review of draft documents, 30 days for revisions and response to comments, and 15 days for EPA approval. Specific dates were determined from the time periods established in the §106 Order.

Based on common construction contracting practice, the final system design package was divided into two parts: (1) plans and specifications, and (2) procurement documents. Once the final design is approved, the procurement process will commence. These activities will be conducted concurrently with preparation of the COMP. Therefore, there is no expected impact to the construction schedule. The actual start of construction may be prior to April 14, 1997, which is the scheduled latest date to begin construction.

References

- Bechtel National, Inc. (Bechtel), 1985. Hydrogeologic and Chemical Data Review and Analysis for the NEC Site, Mountain View, California, October.
- Bechtel, 1986. Soil and Groundwater Chemistry and Hydrogeologic Investigations, NEC Electronics Inc., Mountain View, California, April.
- Bechtel, 1989. Phase III Hydrogeologic Investigation Field Documentation Report, September.
- Bechtel, 1991a. Long Term Pumping Test Report, 501 Ellis Street, Mountain View, California, June.
- Bechtel, 1991b. Phase IV Soil Investigation, 501 Ellis Street, Mountain View, California, July.
- Bechtel, 1991c. Source Control Workplan for 501 Ellis Street, Addendum A: Summary of Hydrogeology and Addendum B: Saturated Soil Sampling Plan, September.
- Bechtel, 1991d. Quality Assurance Project Plan for NEC Electronics Inc., Mountain View, California, September.
- Bechtel, 1991e. Field Sampling Plan for NEC Electronics Inc., Mountain View, California, September.
- Bechtel, 1991f. Safety, Health, and Emergency Response Plan for NEC Electronics Inc., Mountain View, California, September.
- Bechtel, 1992a. Soil Remediation Report for 501 Ellis Street, Mountain View, California, March.
- Bechtel, 1992b. NEC Electronics Inc., Routine Ground-Water Monitoring Report, First Half 1992, June.
- Bechtel, 1995a. Addendum 1 to the Phase IV Soil Investigation, 501 Ellis Street, Mountain View, California, June.
- Bechtel, 1995b. Addendum 1 to the Soil Remediation Report for 501 Ellis Street, Mountain View, California, June.
- Bechtel, 1995c. Saturated Soil Investigation, Revision 1, 501 Ellis Street, Mountain View, California, June.
- Bechtel, 1996a. Source Control Groundwater Remediation Preliminary Design, 501 Ellis Street, Mountain View, California, January.

- Bechtel, 1996b. Source Control Groundwater Remediation Preliminary Design, Addendum 1, 501 Ellis Street, Mountain View, California, February.
- California Code of Regulations, Title 22, Division 2, Chapter 3.
- California Code of Regulations, Title 22, Division 4.5, Chapters 11 and 18.
- California Code of Regulations, Title 23, Division 3, Chapter 15.
- California Regional Water Quality Control Board, San Francisco Bay Region, July 1994, Order No. 94-087, NPDES No. CAG912003, General Waste Discharge Requirements for Discharge or Reuse of Extracted and Treated Groundwater Resulting From the Cleanup of Groundwater Polluted by Volatile Organic Compounds.
- Canonie Environmental (Canonie), 1991. Unified Quality Assurance Project Plan, Middlefield-Ellis-Whisman Site, Mountain View, California, December.
- Canonie, 1992a. Water Production and Potential Water User Survey Results, Water Reuse Program, Middlefield-Ellis-Whisman Site, Mountain View, California, August.
- Canonie, 1992b. Addendum 1 of the Unified Quality Assurance Project Plan, Middlefield-Ellis-Whisman Site, Mountain View, California, December.
- Code of Federal Regulations, Title 40, Parts 261, 262, and 268.
- Code of Federal Regulations, Title 49, Parts 100 through 177.
- Harding Lawson Associates, 1987. Remedial Investigation/Feasibility Report, Middlefield-Ellis-Whisman Area, Mountain View, California, July.
- J.H. Kleinfelder & Associates, 1983. Phase II Ground Water Investigation, Electronic Arrays Facility, Mountain View, California, March.
- Santa Clara Valley Water District (SCVWD), 1990. Ordinance No. 90-1, An Ordinance of Santa Clara Valley Water District Regulating the Classification, Construction and Destruction of Wells and Other Deep Excavations; Requiring the Destruction of Abandoned or Unused Wells; Adopting Water Contamination Hazard Standards; Making Violation a Misdemeanor; and Repealing Ordinance No. 85-1, May.
- U.S. Environmental Protection Agency (EPA), 1990. Administrative Order for Remedial Design and Remedial Action, Docket No. 91-4, December.

TABLE 1-1

CROSS-REFERENCE TO §106 ORDER REQUIREMENTS

§106 Order Intermediate or Final Design Requirement	SCGWR Section or Attachment Number	SCGWR Section or Attachment Title
Intermediate Design Requirement		
Section IX.D.2.b(2)(a) (Materials and equipment requisitions)	Appendix C	Major Equipment List Materials will be purchased by the general contractor.
Section IX.D.2.b(2)(b) (Site Preparation Requirements)	Appendix B Appendix D	Drawings Specifications
Section IX.D.2.b(2)(c) (Additional process requirements and final process flow diagram)	Appendix B	Piping and Instrumentation Diagram (M-001). Due to the project simplicity, piping and instrument diagram will be used instead of a process flow diagram.
Section IX.D.2.b(2)(d) (Recommended vendor lists)	Appendix C	Major Equipment List Includes recommended vendors.
Section IX.D.2.b(2)(e) (Quality Control Source List)	Not Applicable	In accordance with EPA's January 19,1993 letter to Bernard Yurash of Siltec Corporation, this item has been deleted.
Section IX.D.2.b(2)(f) (Permitting program and plan)	Section 5 Appendix G	Attainment of ARARs, Permits and Performance Standards Permits
Section IX.D.2.b(2)(g) (Punch list of needed items)	Not Applicable	Reserved for discussion of items not included in the Final Design. (All items were addressed).
Final Design Requirement		
Section IX.D.2.b(3)(a)(1)(i), (ii), and (iii) (Plans and Drawings)	Appendix B	Site Drawing (G-001) Construction Drawings (C-001 to C004, E-001 to E-003 and M-001 to M-003) Single Line Utility Drawing (C-001) Piping and Instrumentation Diagram (M-001) Site Fabrication drawings will not be prepared due to the simplicity of the project.

TABLE 1-1 (continued)

CROSS-REFERENCE TO §106 ORDER REQUIREMENTS

§106 Order Intermediate or Final Design Requirement	SCGWR Section or Attachment Number	SCGWR Section or Attachment Title
Section IX.D.2.b(3)(a)(2)(i), (ii), and (iii) (Procurements)	Not Applicable	(i) Bid Comparison will be included in separate procurement submittal; (ii) Equipment purchase orders with confirmed delivery dates; and (iii) Plant catalogs cuts will be included in a separate construction submittal. Submittal to the EPA is shown as Item 25 in the Final Design Schedule, Figure 7-1.
Section IX.D.2.b(3)(a)(3)(i), (ii), and (iii) (Manuals)	Section 3	SCGWR Final Design Text includes generalized goals, descriptions, and schedule information. Detailed manuals for (i) operations monitoring; (ii) safety; and (iii) startup, testing and commencement of operation and maintenance will be included in the Operations and Maintenance submittal. A health and safety plan will be included in the COMP submittal.
Section IX.D.2.b(3)(a)(4) (Work Orders for Engineers)	Not Applicable	In accordance with EPA's January 19,1993 letter to Bernard Yurash of Siltec Corporation, this item has been deleted.
Section IX.D.2.b(3)(b) (Construction QA/QC Plan)	Section 4 Appendix E	Site Management and Quality Assurance Construction QA/QC Plan A general plan and organization is included. A more detailed QApjP will be included in the COMP submittal
Section IX.D.2.b(3)(c) (Access for Sampling on Adjacent Property)	Appendix H	Adjacent Property Access
Section IX.D.2.b(3)(d) (Compliance with Performance Standards and ARARs)	Section 5	Attainment of ARARs, Permits and Performance Standards

Note:

a) Italicized text indicates items agreed upon with EPA (February 21, 1996 meeting)

TABLE 2-1

VERTICAL HYDRAULIC GRADIENTS IN
A AND B AQUIFER WELL PAIRS
(May 25, 1995)

Monitoring Well Pairs	Vertical Gradient	Average Aquifer Thickness	Direction
NEC3A - NEC3B1	0.024	14.5	Up
NEC8A - NEC8B1	0.144	14.5	Up
NEC8B1 - NEC8B2	0.393	16.5	Up
NEC8B2 - NEC8B3	0.015	25.0	Down
NEC9A - NEC9B1	0.031	26.2	Up
NEC10A - NEC10B1	0.072	14.5	Up
NEC12A - NEC12B1	0.074	14.5	Up
NEC13A -NEC13B1	0.123	14.5	Up
NEC14A - NEC14B1	0.125	14.5	Up
NEC15A - NEC15B1	0.150	14.5	Up
NEC16A - NEC16B1	0.104	14.5	Up
NEC17A - NEC17B1	0.079	14.5	Up
NEC18A - NEC18B1	0.136	14.5	Up
NEC18B1 - NEC18B2	0.118	16.5	Up
NEC19A - NEC19B1	0.019	14.5	Up
NEC20A - NEC20B1	0.008	14.5	Up
NEC21A -NEC21B1	0.017	22.9	Up

TABLE 2-2

TCE CONCENTRATIONS IN GROUNDWATER
PRIOR TO AND FOLLOWING REMEDIATION*
OF VADOSE ZONE SOILS AT 501 ELLIS STREET

•	TCE Conce	entration (µg/L)				TCE C	oncentration	(μg/L)			
	Prior to 1	Remediation		Following Remediation							
Well ID	Apr 1991	Oct/Nov 1991	June 1992	Sept 1992	Dec 1993	Mar 1994	June 1994	Sept 1994	Dec 1994	Apr 1995	July 1995
	2222					.=00					
NEC1A	2000	2400	1900	1500	1300	1700	1500	1800	1400	1600	1700
NEC3A	850	1000	780	770	240	320	280	260	220	190	140
NEC7A	420	500	340	360	69	64	77	54	55	89	91
NEC8A	NS	15	NS	13	23	28	32	28	32	15	43
NEC9A	34	63	53	61	58	59	76	81	76	59	94
NEC10A	NS	180	NS	84	82	120	99	99	34	95	85
NEC11A	NS	120	NS	230	130	140	180	180	130	110	140
NEC12A	NS	ND (2.0)	NS	ND (2.0)	ND (20)	ND (2.0)	ND (2.0)	ND (2.0)	ND (2.0)	ND (2.0)	ND(2.0)
NEC20A	NS	NS	NS	ND (20)	ND (2.0)	ND (2.0)	ND (2.0)	ND (20)	ND (2.0)	ND (2.0)	ND(2.0)
NEC21A	270	460	210	310	250	350	450	430	370	270	370
NEC22A	220	270	270	320	370	440	330	330	290	250	290
NEC23A	NS	230	NS	200	200	220	220	210	170	200	220
NEC24A†			53	61	52 ·	100	140	120	120	130	150

Notes.

* Remediation completed December 1991

NS - Not sampled

ND - Not detected above stated limit

† - Well NEC24A installed December 1991



TABLE 2-3

GROUNDWATER MONITORING RESULTS FOR A AQUIFER WELLS (JULY 1995)

WELL ID	NEC1 A	NEC3A	NEC7A	NEC8A	NEC9A	NEC10A	NEC11A	NEC12A	NEC20A	NEC21A	NEC22A	NEC23A	NEC24A
DATE OF SAMPLE	07/12/95	07/11/95	07/11/95	07/11/95	07/11/95	07/12/95	07/12/95	07/11/95	07/11/95	07/11/95	07/12/95	07/11/95	07/11/95
I ABORATORY ID UNITS	950792205 μg/L	950765906 µg/L	950765904 µg/L	950765903	950765902 µg/L	950792202	950792203	950765909 µg/L	950765908 µg/L	950765910	950792204	950765907 μg/L	950765905
UNIIS		дв/ц	μg/L	μg/L	μg/L	μg/L	μg/L	µg/L	μg/L	μg/L	μg/L	μg/L	μg/ <u>L</u>
Volatile Organics (a)													
Acetone	ND (125)	ND (10)	ND (10)	ND (10)	10	ND (10)	ND (10)	ND (10)	ND (10)	ND (29)	ND (29)	ND (14)	ND (10)
Benzenc	ND (25)	ND (2 0)	ND (2 0)	ND (2 0)	ND (20)	ND (2 0)	ND (2 0)	ND (2 0)	ND (20)	ND (5 8)	ND (5 8)	ND (2 9)	ND (2 0)
Bromodichloromethane	ND (25)	ND (2 0)	ND (2 0)	ND (20)	ND (2 0)	ND (20)	ND (2 0)	ND (20)	ND (2 0)	ND (5 8)	ND (5 8)	ND (2 9)	ND (2 0)
Bromoform	ND (25)	ND (2 0)	ND (2 0)	ND (2 0)	ND (2 0)	ND (20)	ND (2 0)	ND (2 0)	ND (2 0)	ND (5 8)	ND (5 8)	ND (2 9)	ND (2 0)
Bromomethane	ND (25)	ND (2 0)	ND (2 0)	ND (2 0)	ND (2 0)	ND (2 0)	ND (2 0)	ND (2 0)	ND (20)	ND (5 8)	ND (5 8)	ND (2 9)	ND (2 0)
2-Butanone	ND (125)	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)	ND (29)	ND (29)	ND (14)	ND (10)
Carbon Disulfide	ND (25)	ND (2 0)	ND (2 0)	ND (2 0)	ND (2 0)	ND (20)	ND (2 0)	ND (2 0)	ND (20)	ND (5 8)	ND (5 8)	ND (2 9)	ND (2 0)
Carbon Tetrachloride	ND (25)	ND (2 0)	ND (2 0)	ND (2 0)	ND (2.0)	ND (20)	ND (2 0)	ND (20)	ND (20)	ND (5 8)	ND (5 8)	ND (2 9)	ND (2 0)
Chlorobenzene	ND (25)	ND (2 0)	ND (20)	ND (2 0)	ND (20)	ND (2 0)	ND (2 0)	ND (20)	ND (2 0)	ND (5 8)	ND (5 8)	ND (2 9)	ND (2 0)
Chloroethane	ND (25)	ND (2 0)	ND (20)	ND (20)	ND (20)	ND (2 0)	ND (2 0)	ND (2 0)	ND (2 0)	ND (5 8)	-ND (5 8)	ND (2 9)	ND (2 0)
2-Chloroethyl vinyl ether	ND (125)	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)	ND (29)	ND (29)	ND (14)	ND (10)
Chloroform	ND (25)	ND (2 0)	ND (2 0)	ND (2 0)	ND (20)	ND (20)	ND (20)	ND (20)	ND (20)	ND (5 8)	ND (5 8)	ND (2 9)	ND (2 0)
Chloromethane	ND (25)	ND (2 0)	ND (2 0)	ND (2 0)	ND (2 0)	ND (20)	ND (2 0)	ND (2.0)	ND (20)	ND (5 8)	ND (5 8)	ND (2 9)	ND (2 0)
Dibromochloromethane	ND (25)	ND (2 0)	ND (2 0)	ND (2 0)	ND (2 0)	ND (2 0)	ND (2 0)	ND (20)	ND (2 0)	ND (5 8)	ND (5 8)	ND (2 9)	ND (2 0)
1,1-Dichloroethanc	ND (25)	ND (2 0)	ND (2 0)	ND (2 0)	ND (20)	ND (2 0)	ND (2 0)	ND (20)	ND (2 0)	ND (5 8)	ND (5 8)	ND (2 9)	ND (2 0)
1,2-Dichloroethane	ND (25)	ND (20)	ND (2 0)	ND (2 0)	ND (2 0)	ND (2 0)	ND (2 0)	ND (2 0)	ND (2 0)	ND (5.8)	ND (5 8)	ND (2 9)	ND (2 0)
1,1-Dichloroethene	ND (25)	ND (2 0)	ND (2 0)	ND (2 0)	ND (2 0)	ND (2 0)	ND (20)	ND (2 0)	ND (2 0)	ND (5 8)	ND (5 8)	ND (2 9)	ND (2 0)
cis-1,2-Dichlorocthene	34	77	28	38	8.5	37	2 4	ND (20)	ND (2 0)	27	40	72	24
trans-1,2-Dichloroethene	ND (25)	3 3	ND (2 0)	ND (20)	ND (2 0)	ND (2 0)	ND (2 0)	ND (2 0)	ND (2.0)	ND (5 8)	ND (5 8)	ND (29)	ND (2 0)
1,2-Dichloropropanc	ND (25)	ND (2.0)	ND (2 0)	ND (2 0)	ND (2 0)	ND (20)	ND (2 0)	ND (2 0)	ND (2 0)	ND (5 8)	ND (5 8)	ND (2 9)	ND (2 0)
cis-1,3-Dichloropropene	ND (25)	ND (2 0)	ND (20)	ND (2 0)	ND (2 0)	ND (2 0)	ND (2 0)	ND (2 0)	ND (2 0)	ND (5 8)	ND (5 8)	ND (2 9)	ND (2 0)
trans-1,3-Dichloropropene	ND (25)	ND (2.0)	ND (20)	ND (2 0)	ND (2 0)	ND (20)	ND (2 0)	ND (2 0)	ND (20)	ND (5 8)	ND (5 8)	ND (2 9)	ND (2 0)
Ethylbenzene	ND (25)	ND (2 0)	ND (2.0)	ND (20)	ND (2 0)	ND (2 0)	ND (2.0)	ND (2 0)	ND (2 0)	ND (5 8)	ND (5 8)	ND (2 9)	ND (2 0)
2-Hexanone	ND (125)	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)	ND (29)	ND (29)	ND (14)	ND (10)
Methylene Chloride	ND (62)	ND (5 0)	ND (5 0)	ND (5 0)	ND (5 0)	ND (5 0)	ND (5 0)	ND (5 0)	ND (5 0)	ND (14)	ND (14)	ND (7 2)	ND (5 0)
4-Mcthyl-2-pentanone	ND (125)	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)	ND (29)	ND (29)	ND (14)	ND (10)
Styrene	ND (25)	ND (2.0)	ND (2 0)	ND (20)	ND (2 0)	ND (2 0)	ND (2 0)	ND (2 0)	ND (20)	ND (5.8)	ND (5 8)	ND (2.9)	ND (2 0)
1,1,2,2-Tetrachloroethane	ND (25)	ND (2.0)	ND (2 0)	ND (2 0)	ND (2 0)	ND (2 0)	ND (2.0)	ND (2 0)	ND (2 0)	ND (5.8)	ND (5 8)	ND (2 9)	ND (2.0)
Tetrachloroethene	ND (25)	ND (2.0)	ND (2.0)	ND (2.0)	ND (2 0)	ND (2 0)	ND (2.0)	ND (2 0)	ND (2 0)	ND (5 8)	ND (5 8)	ND (2 9)	ND (2.0)
Toluenc	ND (25)	ND (2 0)	ND (2.0)	ND (2.0)	ND (2 0)	ND (2 0)	ND (2 0)	ND (2 0)	ND (2 0)	ND (5 8)	ND (5 8)	ND (2 9)	ND (2 0)
1,1,1-Trichloroethane	ND (25)	ND (2 0)	ND (2.0)	ND (20)	ND (20)	ND (2 0)	ND (2 0) ND (2 0)	ND (2 0) ND (2 0)	ND (2 0)	ND (5 8)	ND (5 8)	ND (2 9)	ND (2 0)
1,1,2-Trichloroethane	ND (25)	ND (2 0) ND (2 0)	ND (2.0) ND (2.0)	ND (20) ND (20)	• •	ND (2 0) ND (2 0)		• •		• •			
• •	1700	ND (2 0) 140	ND (2 0) 91	ND (20) 43	ND (2 0)	ND (2 0) 85	ND (2 0)	ND (2 0)	ND (2.0)	ND (5 8)	ND (5 8)	ND (2 9) 220	ND (2 0)
Trichloroethene					94 ND (2.0)		140	ND (2.0)	ND (2 0)	370	290		150
Trichlorofluoromethane	ND (25)	ND (2 0)	ND (2 0)	ND (2 0)	ND (2.0)	ND (2 0)	ND (2 0)	ND (2 0)	ND (2 0)	ND (5 8)	ND (5 8)	ND (2 9)	ND (2 0)
Vinyl Acetate	ND (62)	ND (5 0)	ND (5 0)	ND (5.0)	ND (5 0)	ND (5 0)	ND (5 0)	ND (5 0)	ND (5 0)	ND (14)	ND (14)	ND (7 2)	ND (5 0)
Vinyl Chloride	ND (25)	ND (2 0)	ND (2 0)	ND (2 0)	ND (2 0)	ND (2 0)	ND (2 0)	ND (2 0)	ND (2 0)	ND (5 8)	ND (5 8)	ND (2 9)	ND (2 0)
Xylene	ND (25)	ND (2 0)	ND (2 0)	ND (2 0)	ND (2 0)	ND (2 0)	ND (2 0)	ND (2 0)	ND (2 0)	ND (5.8)	ND (5 8)	ND (2 9)	ND (2 0)
Frcon 113	26	ND (2 0)	ND (2 0)	4 5	ND (2 0)	ND (2 0)	ND (2 0)	ND (2 0)	ND (2 0)	ND (5 8)	ND (5 8)	ND (2.9)	ND (2 0)

Notes (a) Analyzed in accordance to EPA Method 8240 by Sequoia Analytical Laboratory

ND - Not present above stated limit of detection

TABLE 5-1 SUMMARY OF IDENTIFIED PERMITS

Applicability/Purpose	Permit	Regulatory Agency	Approach/Status
Installation of Groundwater Extraction Wells	Well Construction Permit	Santa Clara Valley Water District (SCVWD)	Submit applications upon approval of Final Design. Approval process expected to take approximately 2 to 4 weeks.
Construction of Groundwater Treatment Unit	Building Permit	City of Mountain View Planning Department	Initial contacts with City have been established. Application will be submitted upon approval of Final Design.
Discharge of Treated Groundwater to Publicly- Owned Treatment Works (POTW)	Amendment to Liquid Waste Discharge Permit No. 901	City of Mountain View Environmental Safety Division	Preliminary discussion with City indicates an amendment will be granted. Application will be submitted.
Discharge of Treated Groundwater to Storm Drain	National Pollutant Discharge Elimination System NPDES No. CAG912003	Regional Water Quality Control Board (RWQCB)	Application will be submitted if discharge to POTW is not granted.

TABLE 5-2

MAXIMUM CONTAMINANT LEVELS FOR
§106 ORDER ORGANIC CHEMICALS OF CONCERN

	Federal	State
Constituent	MCL (μg/L) (a)	MCL (μg/L) (b)
1.1 Diablementhans		
1,1-Dichloroethane	-	-
1,1-Dichloroethene	7	6
1,2-Dichlorobenzene	-	-
1,2-Dichloroethene	-	-
1,1,1-Trichloroethane	200	-
Chloroform	100 (c)	-
Freon 113	-	1200
Phenol	-	-
Tetrachloroethene	-	-
Trichloroethene	5	5
Vinyl Chloride	2	0.5

Notes:

- A dashed line indicates that State or Federal MCLs were not available.
- MCL Maximum Contaminant Level.
- (a) Federal MCLs as mandated by the ROD.
- (b) State MCLs from the ROD.
- (c) Total trihalomethanes.

TABLE 5-3

NPDES GENERAL PERMIT EFFLUENT DISCHARGE LIMITS ORDER NO. 94-087 (July 20, 1994)

Constituent	Instantaneous Maximum Limit
	(μg/L)
Organics	
Purgeable Halocarbons	
1,1,1-Trichloroethane	5.0
Tetrachloroethylene	5.0
Trichloroethylene	5.0
1,1-Dichloroethylene	5.0
1,2-Dichloroethane	0.5
Vinyl chloride	0.5
1,2-Dichloroethylene isomers	5.0
1,1-Dichloroethane	5.0
Methylene chloride	5.0
Chloroform	5.0
Any Other purgeable aromatics	5.0
Benzene	1.0
Toluene	5.0
Ethylbenzene	5.0
Total Xylenes	5.0
Total Petroleum Hydrocarbons	50.0
Ethylene dibromide	0.02
Total Polynuclear	
Aromatic Hydrocarbons	15.0
Semi-Volatile Organics	
Base/Neutral fraction, per constituent	5.0
Inorganics	•
Arsenic	10.0
Cadmium	2.2(a)
Chromium (VI)	22.0(b)
Copper	23.6(a)
Lead	6.4(a)
Mercury	1 gram/day(c)
Nickel	320.0(a)
Selenium	10.0
Silver	8.2(a)
Zinc	220.0(a)

Notes:

- (a) (Assumes hardness = 100 mg/l CaCO_3).
- (b) Dischargers, at their option, may meet this limit as total chromium.
- (c) The effluent shall not contain more than 1 gram/day of mercury.

TABLE 6-1 WELL INFORMATION SUMMARY

Well No.	Date Installed	Ground	Reference Elevation	Casing	Screen	Groundwater Level	Chemical
1		Elevation	(Top of PVC)	Diameter	Interval	Measurement	Sampling
-		(ft msl)	(ft msl)	(in)	(ft bgs)		
NEC1A	9/82	44.62	44.47	2	5.0-25.0	X	Х
NECIAE		and salk				X	X
NEC3A	10/85	44.49	43.76	· 4	25.0-28.7	- X	X
NEC7A	10/83	44.15	43.80	2	6.5-26.5	X	X
NEC8A	10/83	42.77	42.29	2	5.0-25.0	X	X
NEC9A	10/83	43.73	43.14	2	5.0-30.0	X	X
NECIIA	8/84	46.26	46.24	2	10.0-30.0	X	
NEC12A	10/85	44.64	44.24	4	18.9-28.3	X	X
NEC20A	1/89	46.93	46.62	4	26.0-28.0	X	X
NEC21A	12/88	. 44.31	44.06	4	26.0-28.0	- X	X
NEC22AE				+-		X	X
NEC23A	5/89	44.00	43.77	4	26.0-28.0	X	X
NEC24A	12/91	44.50	44.50	4	18.7-28.7	X	X
NEC25A	3/96	42.69	42,30	4	15.5-25.5	X	X
NEC26A	3/96	44.24	43.65	4	11.0-16.0	X	X
NEC27AE		v =				X	X

Note:

fect. ft

ms! = mean sea level.

= inch.

= below ground surface.

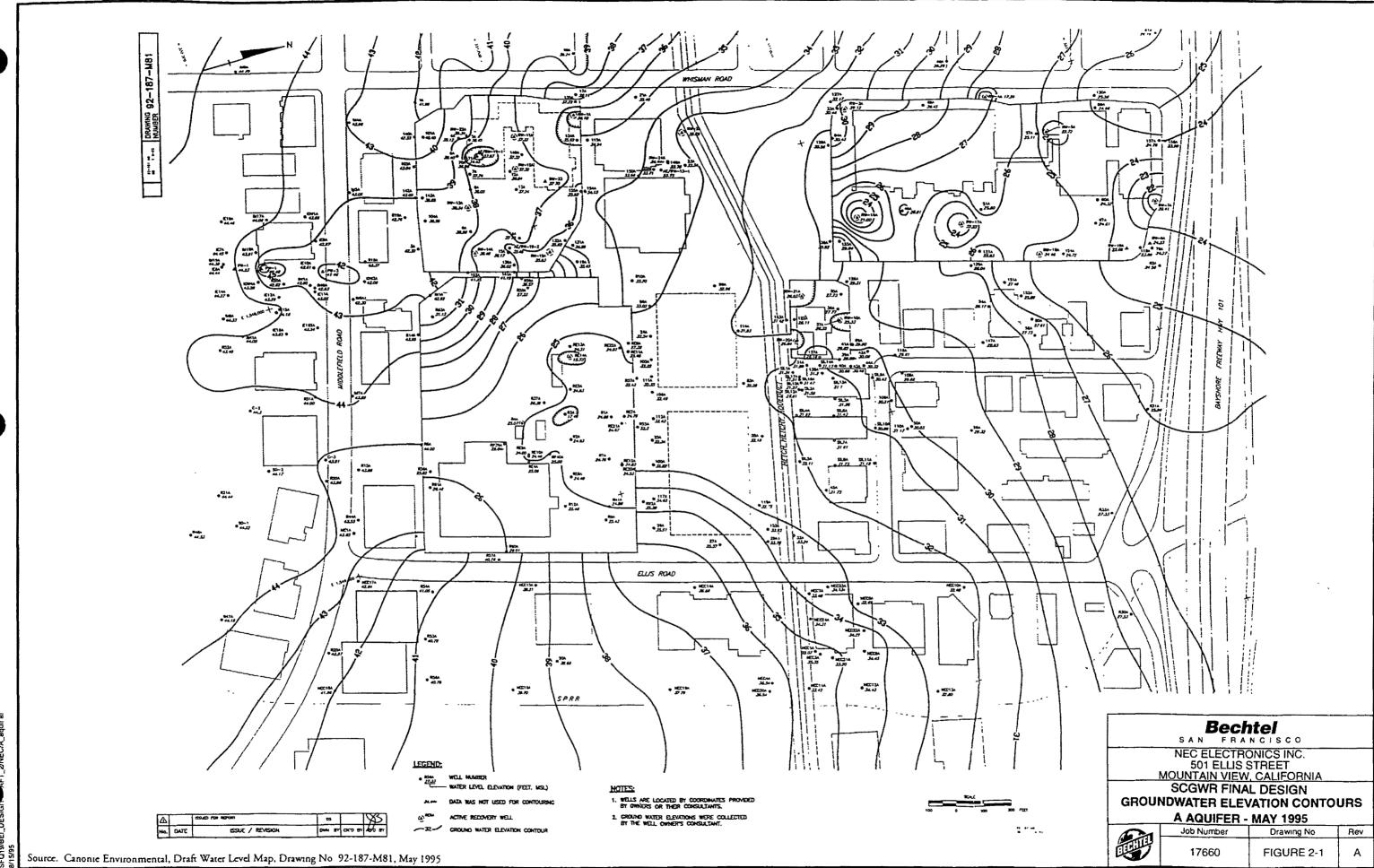
Extraction wells NEC1AE, NEC22AE, NEC27AE are proposed.

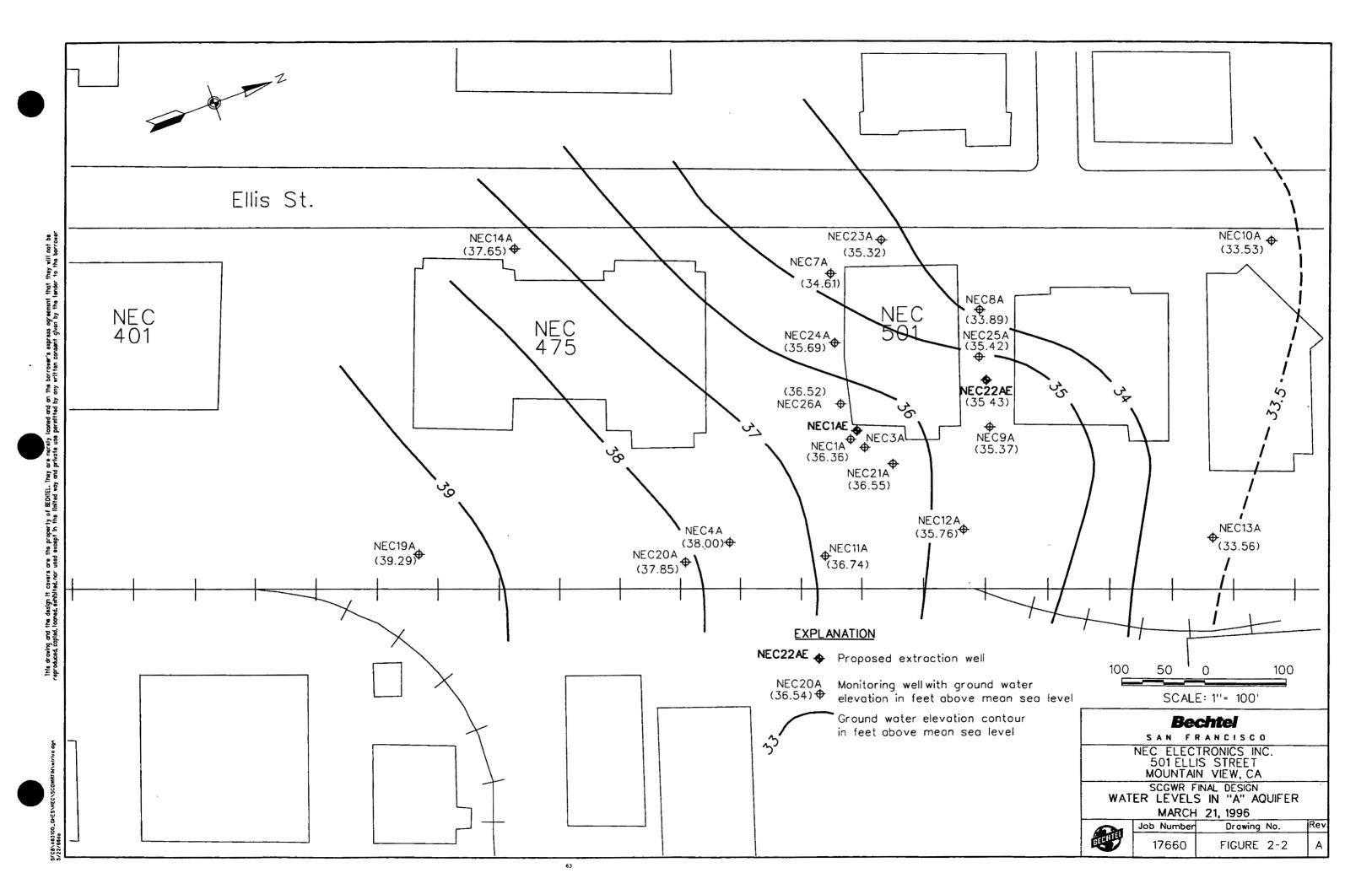
TABLE 6-2 TARGET COMPOUND LIST AND DETECTION LIMITS FOR EPA METHOD 8010

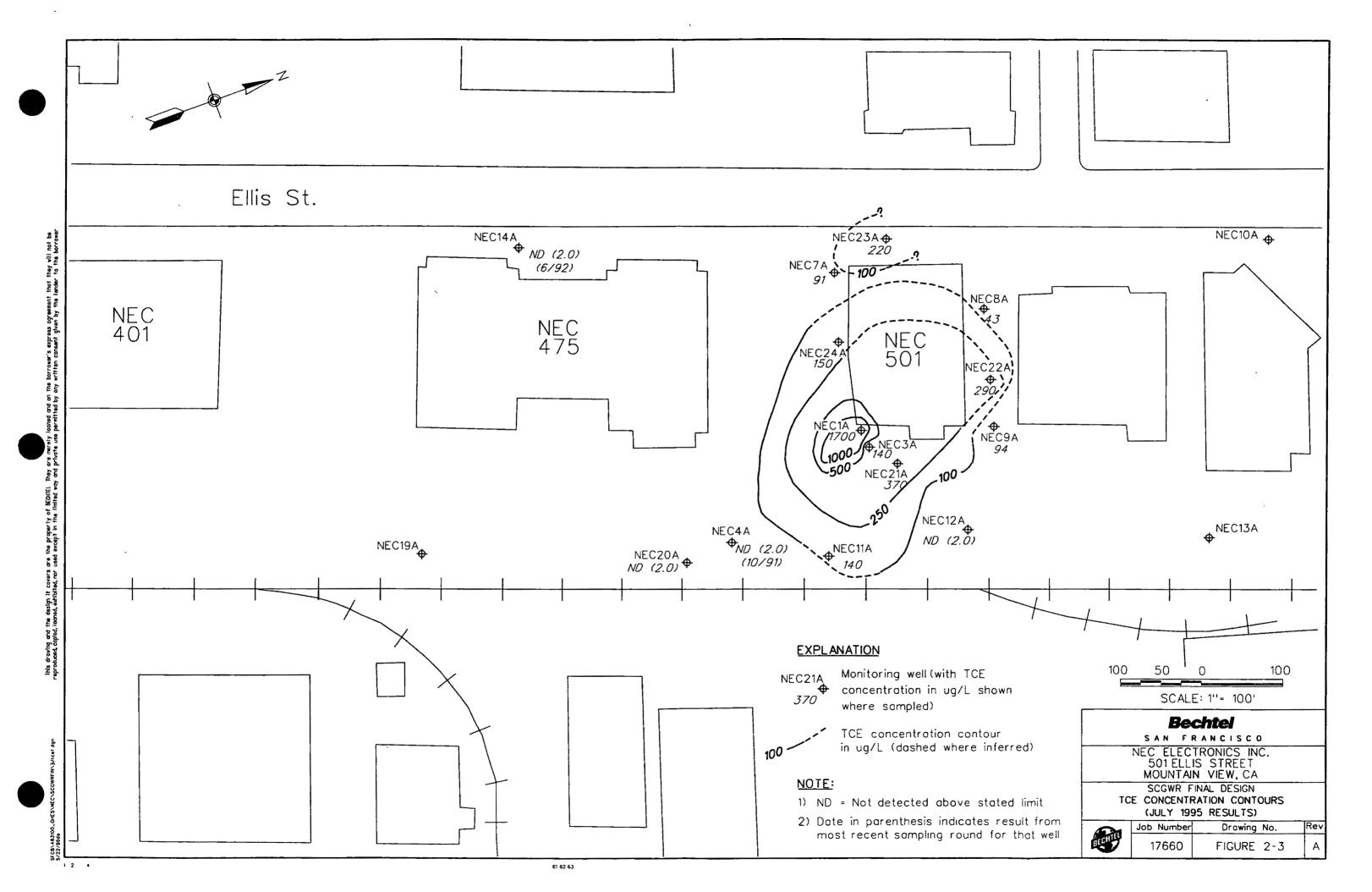
Volatile Organic Compounds	CAS Number	Detection Limits (μg/L)
Bromodichloromethane	75-27-4	0.5
Bromoform	75-25-2	0.5
Bromomethane	74-83-9	1.0
Carbon tetrachloride	56-23-5	0.5
Chlorobenzene	108-90-7	0.5
Chloroethane	75-00-3	1.0
2-Chloroethylvinyl ether	110-75-8	1.0
Chloroform	67 - 66-3	, 0.5
Chloromethane	74-87-3	1.0
Dibromochloromethane	124-48-1	0.5
1,2-Dichlorobenzene	95-50-1	0.5
1,3-Dichlorobenzene	541-73-1	0.5
1,4-Dichlorobenzene	106-46-7	0.5
1,1-Dichloroethane	75-34-1	0.5
1,2-Dichloroethane	107-06-2	0.5
1,1-Dichloroethene	75-35-4	0.5
cis-1,2-Dichloroethene	156-59-4	0.5
trans-1,2-Dichloroethene	156-60-5	0.5
1,2-Dichloropropane	78-87-5	0.5
cis-1,3-Dichloropropene	10061-01-5	0.5
trans-1,3-Dichloropropene	10061-02-6	0.5
Methylene chloride	75-0 9 -2	5.0
1,1,2,2-Tetrachloroethane	79-34-5	0.5
Tetrachloroethene	127-18-4	0.5
1,1,1-Trichloroethane	71-55-6	0.5
1,1,2-Trichloroethane	79-00-5	0.5
Trichloroethene	79-01-6	0.5
Trichlorofluoromethane	75-69-4	0.5
Vinyl chloride	75-01-4	1.0

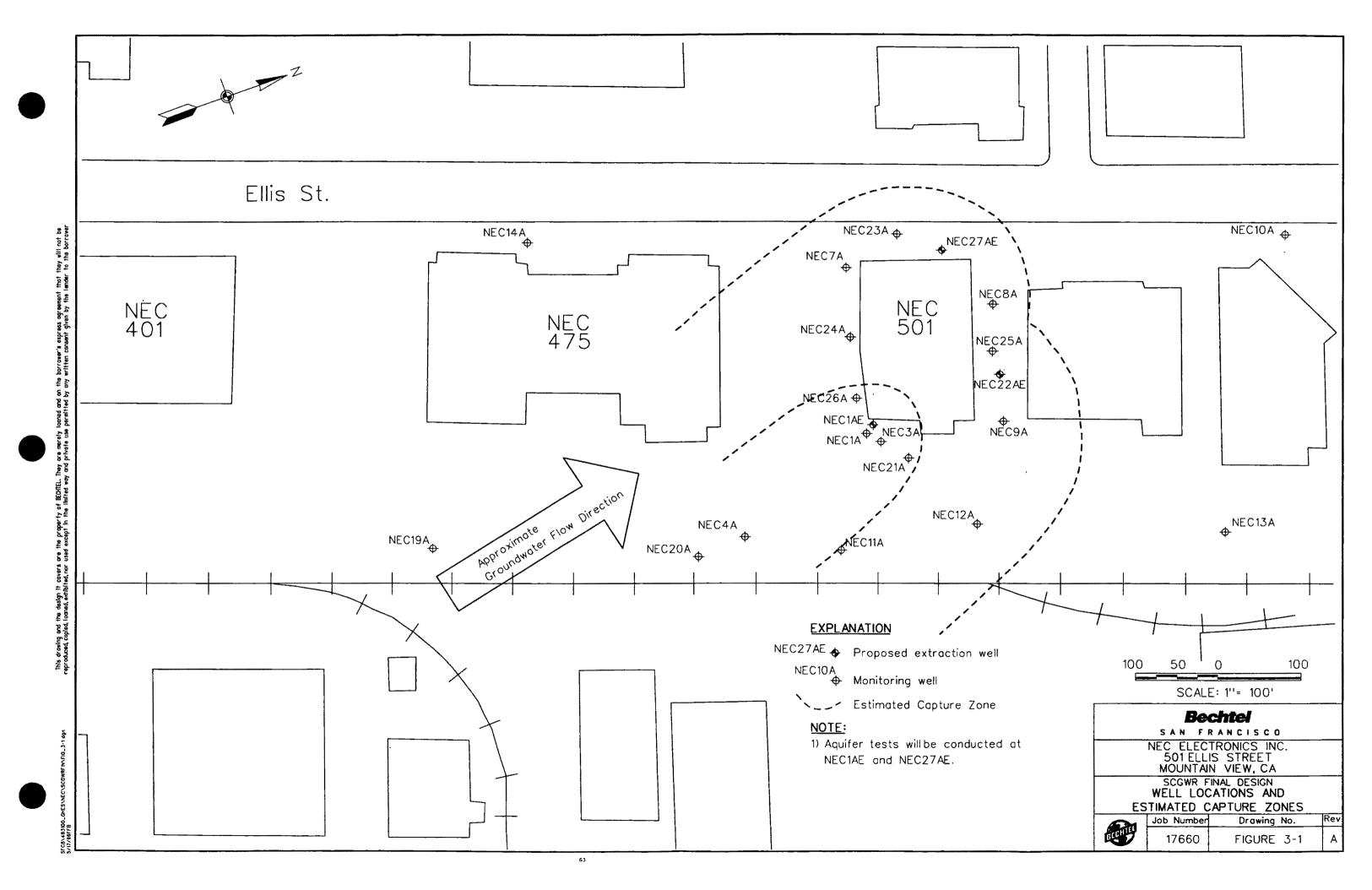
TABLE 6-3 TARGET COMPOUND LIST AND DETECTION LIMITS FOR EPA METHOD 8020

Aromatic Volatile Organic Compounds	CAS Numbers	Detection Limits (μg/L)
Benzene	71-43-2	0.5
Chlorobenzene	108-90-7	0.5
1,2-Dichlorobenzene	95-50-1	0.5
1,3-Dichlorobenzene	541-73-1	0.5
1,4-Dichlorobenzene	106-46-7	0.5
Ethylbenzene	100-41-4	0.5
Toluene	108-88-3	0.5
Total xylenes	1330-20-7	0.5









NOTES:

 Field modification of the well design may be necessary based on observation of the subsurface formation during drilling of the boring.

Bechtel

SAN FRANCISCO

NEC ELECTRONICS INC. 501 ELLIS STREET MOUNTAIN VIEW, CALIFORNIA SCGWR FINAL DESIGN

EXTRACTION WELL DESIGN

6	Job Number	Drawing No	Rev
	17660	FIGURE 3-2	В

NOTE:

1) Existing monitoring well NEC22A will be converted to extraction well NEC22AE.

Bechtel FRANCISCO

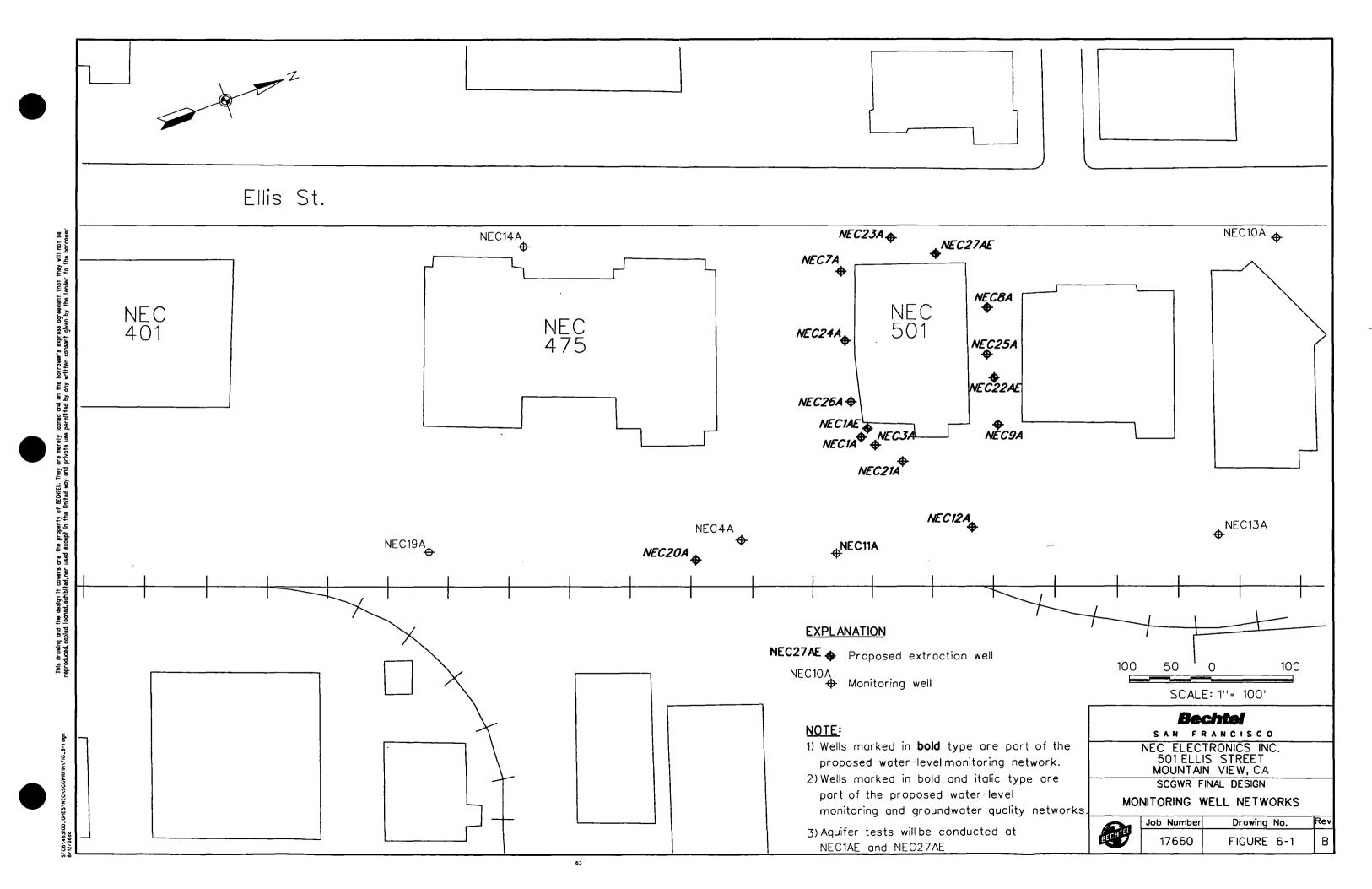
SAN

NEC ELECTRONICS INC. 501 ELLIS STREET MOUNTAIN VIEW, CALIFORNIA SCGWR FINAL DESIGN

EXTRACTION WELL NEC22AE SCHEMATIC

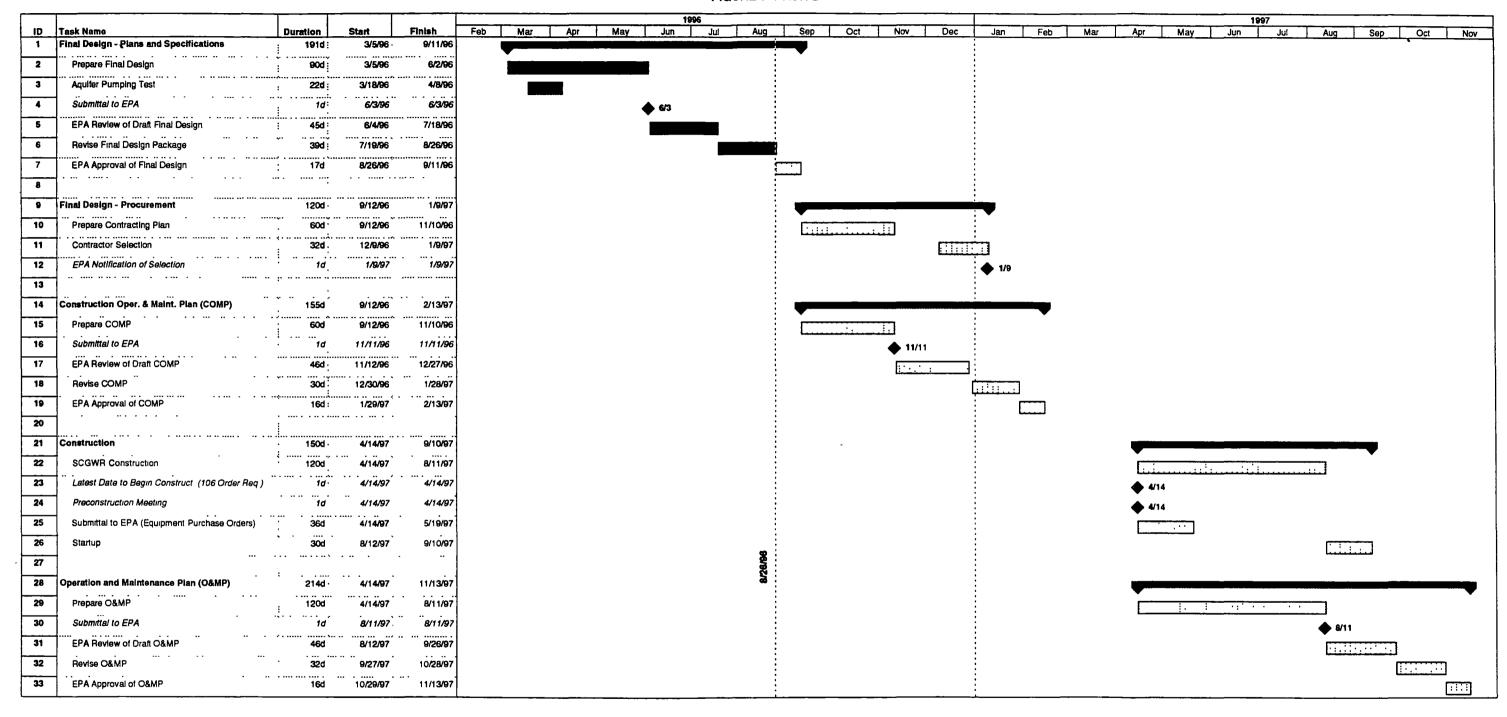


OIILMAIIO		
Job Number	Drawing No	Rev
17660	FIGURE 3-3	В



SCGWR FINAL DESIGN FINAL DESIGN SCHEDULE

FIGURE 7-1 Rev. B



Project. SCGWR Final Design Date: 8/14/96

Task Duration Completed

Task Duration To-Be-Completed

Scheduled Milestone

Summary



Table of Contents

Section		Page	
A1	INTRODUCTION		
	A1.1 Scope A1.2 Summary of Results	A-1 A-2	
A2	CONDUCT OF WORK		
	A2.1 Construction and Development of Wells A2.2 Water-Level Monitoring A2.3 Pumping Tests	A-2 A-4 A-4	
A3	RESULTS	A-6	
	A3.1 Hydraulic Containment System Parameters	A-6	
	FIGURES		
A-1 A-2 A-3 A-4 A-5 A-6 A-7 A-8 A-9 A-10 A-11	Proposed Groundwater Extraction and Monitoring Well Network Drawdown vs. Time in NEC25A Step-Test Drawdown vs. Time in NEC22A at 3 GPM Drawdown vs. Time in NEC25A at 3 GPM Drawdown vs. Time in NEC25A at 2 GPM Residual Drawdown vs. t/t' in NEC25A - 3 GPM Test Drawdown vs. Time in NEC25A - 2 GPM Residual Drawdown vs. t/t' in NEC25A - 2 GPM Test Drawdown vs. t/t' in NEC25A - 1 GPM Residual Drawdown vs. t/t' in Well NEC 12A Water Levels in "A" Aquifer March 21, 1996		
ATTACHMENT			

Geologic Log and Well Details - NEC25A and NEC26A

A-1

Aquifer Test Results

A1 INTRODUCTION

The Source Control Groundwater Remediation (SCGWR) system is proposed to address elevated volatile organic compound (VOC) groundwater concentrations beneath the 501 Ellis Street site. It was recognized from the sampling of the existing monitoring wells, as well as from the lithology of the aquifer, that the hydraulic conductivity is low and the aquifer thin. Yield of interceptor wells was expected to be low and the area of influence would be limited. However, more definitive measures of the aquifer characteristics were needed before an effective collection system design could be provided. To provide that information, aquifer pumping tests were completed in the A aquifer during the week of March 18, 1996. The data collected from that work, together with previously collected data, were then applied in determining aquifer parameters and designing a groundwater control and collection system for the site.

A1.1 Scope

Pumping tests were conducted in two existing wells: NEC22A and NEC12A. During the tests water levels in nearby wells were monitored to measure the area of influence and rate of drawdown. Two additional monitoring wells were constructed prior to the tests to provide detail on the areas of influence (Figure A-1). The tests in NEC22A commenced with a step-discharge test on March 19, 1996. Two constant-rate tests were conducted in this well on March 20, 1996. These included a 140 minute test at 3 gallons per minute (gpm) and a 240 minute test at 2 gpm. Because of the low yield determined at NEC12A, only one constant-rate discharge test was conducted, at a rate of 1 gpm for a period of 390 minutes on March 21, 1996. Water levels were collected in most of the A aquifer monitoring wells each day prior to any groundwater pumping. On March 21, 1996, most of A aquifer wells and B1 aquifer wells were monitored prior to conducting the pumping test in NEC12A. These measurements were taken 16 hours after pumping at NEC22A was stopped and the aquifer had fully recovered.

Wells NEC9A, NEC25A, and NEC8A were used as primary observation wells during these tests. NEC12A was used as an observation well during pumping tests in NEC22A. Other wells were monitored during the course of the pumping tests. However, since these wells were not within the area of influence of the pumping wells, they were only monitored to assess background water levels.

Following the pumping periods, water level recovery data were collected. Aquifer parameters, well capacities and well spacing parameters for the collector system were then determined from the results of these tests. They were determined using methods based on the Theis nonequilibrium concept of groundwater flow, and considered the distribution of materials comprising the A aquifer as indicated by the geologic logs. Water level data collected on March 21, 1996 were used to prepare a water level contour map to provide a measure of flow directions, capture areas, and underflow quantities that will be required to be intercepted. These water level measurements were collected 16 hours after completion of the pumping tests in NEC22A, and represent fully recovered aquifer conditions.

A1.2 Summary of Results

The pumping tests indicate that the transmissivity of the aquifer is quite low, and that the long-term total extraction rate to intercept/capture the impaired groundwater plume in the A aquifer is 1 to 1.5 gpm. To effectively accomplish this, a three-well interceptor system is planned. One well will be located within or just downgradient of the apparent source area and the other 2 wells will be located on the downgradient periphery of the plume. Spacing between the wells will be approximately 130 feet to optimize the expected capture zone of each well, as indicated by the pumping test results.

It is expected that each well will extract an average of 0.5 gpm, but the actual rate of extraction may vary, depending on the method of operation. For example, the wells could operate on a cyclical basis rather than a continuous low-flow basis. The actual pumping rates will depend first on the aquifer capacity and underflow capacity and, secondly, on the water processing and disposal system requirements.

A2 CONDUCT OF WORK

A2.1 Construction and Development of Wells

Monitoring wells NEC25A and NEC26A were installed on March 18, 1996. Well NEC25A was installed 20 feet from NEC22A to serve as an observation well for the aquifer tests (Figure A-1). NEC25A was installed to a depth of 30 feet, with 10 feet of screen across a silty sand aquifer zone. The well was drilled to a blue clay aquitard, encountered at a depth of 29 feet. This clay appears to be a local aquitard that was identified in most other borings at this site.

Well NEC26A was installed near existing well NEC1A, along the southeastern corner of the building (Figure A-1). This well was installed to a depth of 20 feet, and monitors a sandy gravel unit encountered from 11 to 16 feet bgs. This well will be used as an observation well for an extraction well located in the apparent source area.

The borings were drilled with 10-inch diameter hollow-stem augers using a Mobile B61 drill rig. Three soil samples were collected at each boring using a 2-inch diameter 18-inch long split-spoon sampler and a 140 lb drop hammer to advance the sampler into undisturbed soil. Organic vapors were monitored in the breathing zone and at the borehole as part of the site safety monitoring program.

Both wells were constructed using 4-inch diameter schedule 40 PVC casing, and 0.020-inch factory slotted screens. The filter pack consisted of #3 Lonestar silica sand that extended one foot above the top of the screen. A bentonite seal was placed on top of the filter pack and the annular space was filled with neat cement grout to ground surface and completed with a traffic-rated water-tight box and locking cap. Well construction details and geologic logs of both wells are provided in Attachment A-1.

These wells were developed 24 hours after installation, on March 19, 1996. The wells were developed using a surge block to agitate the water in the well screen interval and a submersible pump to remove the silty water from the well. Well NEC25A was developed for 3 hours during which 100 gallons of water were removed. Water clarity improved only slightly. Due to the very low water level recovery rates, additional development was not performed in NEC25A. The low recovery rates indicate a very low well capacity. At NEC26A, about 120 gallons of development water was produced. Suspended sediments reduced after about 50 gallons of water was removed and the water cleared after 80 gallons were removed. Water level recovery was rapid, and development cycles of swabbing and pumping required no waiting time.

Well NEC22A were developed on March 19, 1996, prior to developing NEC25A and NEC26A. Because NEC22A was the test well, additional development was performed to ensure the filter pack and screen would provide optimal performance during the pumping test. Approximately 160 gallons of water were removed from this well during well development. After approximately 140 gallons, the well produced clear water.

A2.2 Water-Level Monitoring

Water levels were monitored manually in most A aquifer wells each day prior to beginning other work. These water levels are presented in Table A-1. As shown in this table, water levels varied only 0.02 to 0.08 feet from day-to-day.

During the course of the aquifer tests, more frequent measurements were collected in selected wells to monitor background water levels.

A2.3 Pumping Tests

Four pumping tests were conducted. The tests are as follows:

- step-discharge test in NEC22A
- 3 gpm constant-rate discharge test in NEC22A
- 2 gpm constant-rate discharge test in NEC22A
- 1 gpm constant-rate discharge test in NEC12A

The step-discharge test was performed in NEC22A approximately 6 hours after development of the well. Water levels were measured to confirm 100 percent recovery from well development pumping. Transducers and a datalogger were used to collect water level data in the pumping well on a logarithmic time scale beginning at each step. In addition, a transducer was installed in well NEC9A to monitor possible response in that well during the step-discharge test.

An initial discharge rate of 1.0 gpm was selected based on the well yield and recovery observed during well development. After 20 minutes of pumping at 1.0 gpm, drawdown asymptotically approached 2 feet, and the flow rate was stepped to 2.0 gpm. After 40 minutes of pumping at 2.0 gpm the drawdown stabilized near 5 feet and the flow rate was increased to 4.0 gpm. After 22 minutes of pumping at 4 gpm, pumping was stopped because water levels in the well were approaching the transducer and drawdown showed no indication of stabilizing (Figure A-2).

The pump intake was installed at a depth that provided about 18 feet of available drawdown. The 2.0 gpm step test indicated that less than 7 feet of drawdown would occur over a long term test at that flow rate. This drawdown would not adequately stress the aquifer, but the step tests also indicated that the well could not sustain 4 gpm discharge for a long-term test (Figure A-2).

Based on these results, a 3 gpm flow rate was selected for a long-term constant-rate discharge test.

On March 20, a 3 gpm constant-rate discharge test was performed in NEC22A. The test began at 0840. Pumping was stopped after 140 minutes because drawdown reached 16 feet, leaving less than 2 feet of remaining drawdown (Figure A-3). The graph of drawdown in this well indicates a hydrologic barrier or boundary was encountered within the area of influence. At monitoring well NEC25A, about 0.5 feet of drawdown was measured (Figure A-4) and 0.2 feet of drawdown was measured in NEC9A, located 73 feet from the pumping well. No response was observed in NEC8A, located 96 feet from the pumping well.

After water levels recovered to pre-pumping levels in all wells, another constant-rate test was conducted in NEC22A at 2 gpm. This test was stopped after 240 minutes of pumping, again due to excessive drawdown in the pumping well. Again, the boundary effects were evident in the pumping well (Figure A-5).

Response to pumping was observed again in NEC25A (0.33 feet of drawdown) and in NEC9A (0.20 feet of drawdown). No response was measured in NEC8A, NEC12A, or other wells.

Recovery data were collected in NEC22A, NEC25A, and NEC9A; however, only the recovery data from NEC25A was adequate for analysis because there was some backflow from the discharge hose into the pumping well, and the transducer in NEC9A was not sufficiently accurate for analysis.

On March 21, 1996, a pumping test was performed in NEC12A. An initial flow rate of 1.0 gpm was selected based on the conditions observed at NEC22A and similar geologic conditions described in the boring logs. No observation wells were located within 100 feet from the pumping well, but transducers were installed in the two closest A aquifer monitoring wells NEC9A and NEC21A. In addition, water levels were manually measured in NEC11A, NEC12B1 (this well is only 7 feet from the test well, but screened in the B aquifer), and other wells throughout the course of this test.

Well NEC12A was pumped at 1.0 gpm for 390 minutes, and the pumping was stopped at 16 feet of drawdown. Backflow into the pumping was stopped, and recovery data were collected until water levels recovered to greater than 90 percent of pre-pumping levels. No response to pumping was observed in any of the monitored wells, including NEC12B1.

A3 RESULTS

The constant-rate discharge data were analyzed using the Theis nonequilibrium model of groundwater flow. Jacob's modification to the Theis solution for time vs. drawdown data was used to solve for aquifer transmissivity and storativity. Prior to solving for transmissivity, the time where the Theis Well function variable $\mathbf{u} < 0.05$ was calculated to confirm the validity of the analyzed data, and the critical time for casing storage effects was also calculated.

Drawdown vs. time at NEC22A yielded transmissivity values of 35 ft²/day and 21 ft²/day for the 2 and 3 gpm tests, respectively (Figures A-3 and A-5). The data at NEC25A, including recovery data, yielded transmissivity values ranging from 188 to 286 ft²/day (Figures A-4, A-6, A-7, and A-8). Storativity was determined to be 0.003 for each test at NEC25A.

Boring logs indicate that the aquifer thickness at NEC22A is about 3 feet, yielding a hydraulic conductivity of 7 to 10 ft/day. The aquifer thickness at NEC25A is approximately 13 feet of silty sand, which yields a hydraulic conductivity of 14 to 22 ft/day, which is similar to the hydraulic conductivity at the pumping well.

The transmissivity at NEC12A was 6.5 ft²/day. Aquifer thickness is approximately 9 feet of silty sand. Hydraulic conductivity is approximately 0.7 ft/day, an order of magnitude less than the hydraulic conductivity calculated at NEC25A and NEC22A. The rate of drawdown in NEC12A was variable, and the plot of the data showed an unusual pattern in the drawdown curve, with 0.5 foot incremental "steps" that were not associated with any changes in pumping conditions such as flow rate adjustments or generator surges (Figure A-9). The recovery data does not lend itself to analysis because a straight line cannot be fitted to the semi-log plot (Figure A-10).

Overall these results indicate a very low transmissivity in a heterogeneous aquifer. Each of the three constant-rate pumping tests indicated low permeability boundary effects were evident as the cone of depression expanded away from the pumping well. At NEC22A, boundary effects were observed less than 100 minutes after pumping started.

A3.1 Hydraulic Containment System Parameters

The width or area of the impaired aquifer was estimated using the A aquifer plume maps. It appears that an area about 500 feet wide, as measured perpendicular to groundwater flow direction, needs to be captured at the northern property boundary. Average horizontal hydraulic

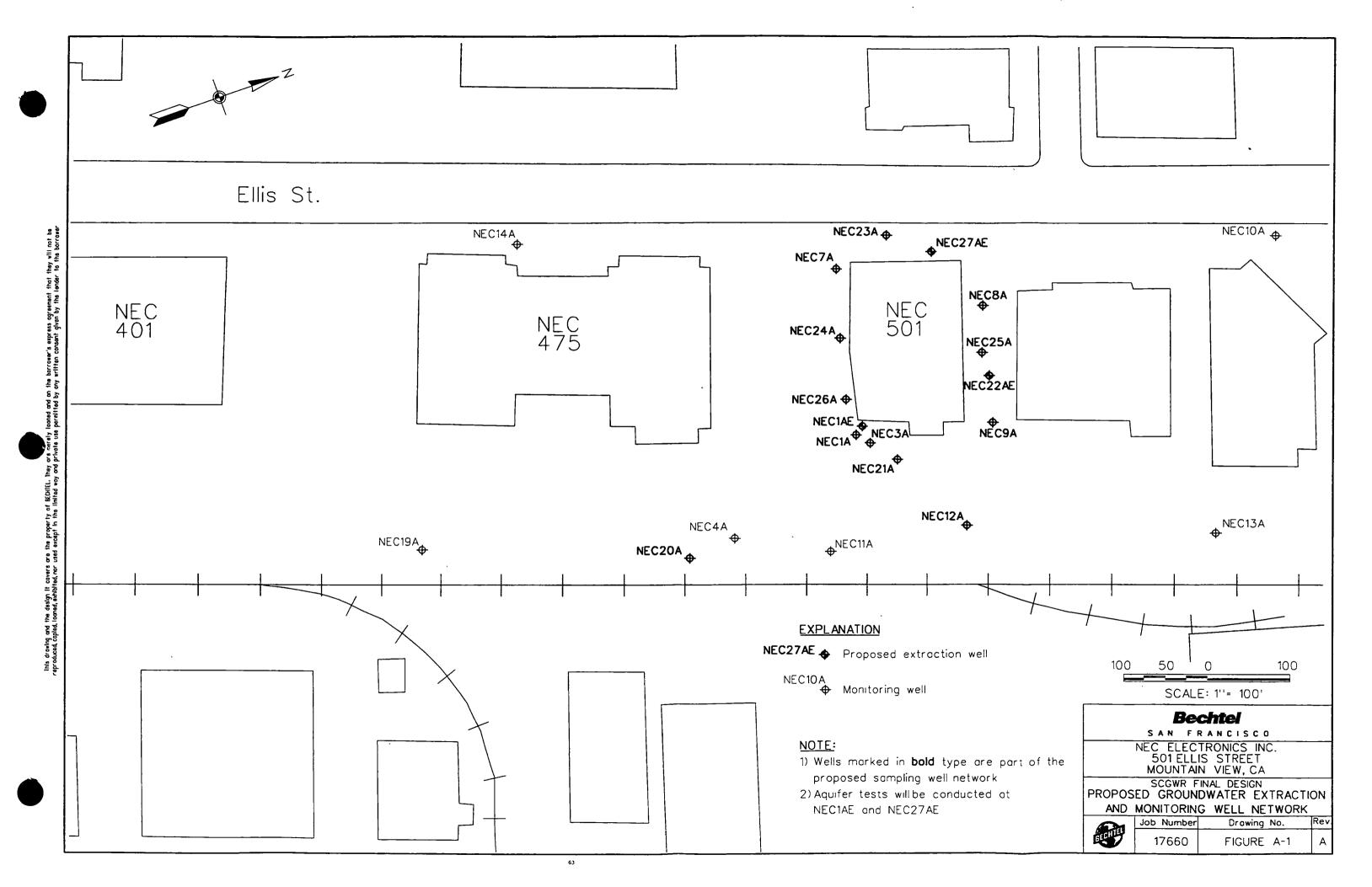
gradient, as measured on March 21, 1996 was 0.009. A transmissivity of 35 ft²/day was used to estimate the aquifer underflow across the site using the following equation:

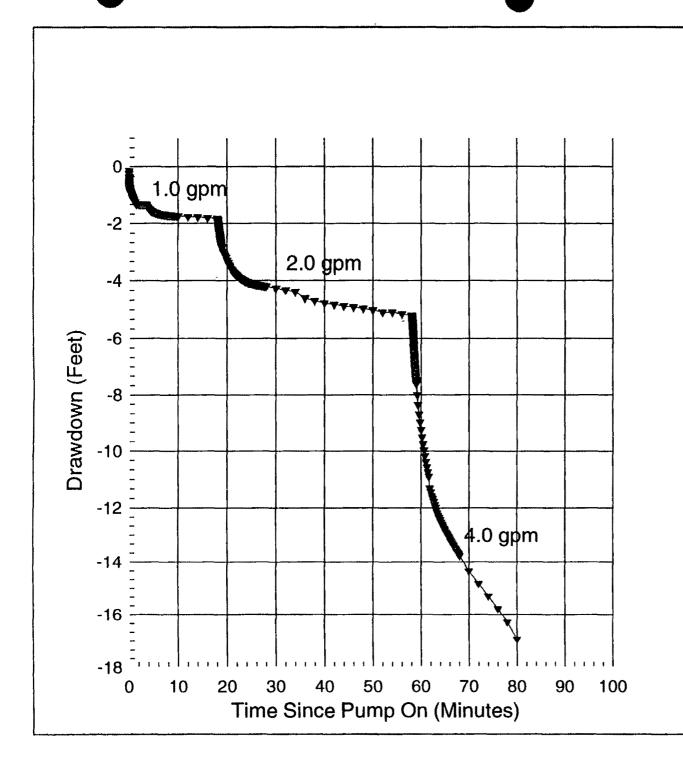
> $Q = T \times i \times W$ where $Q = underflow 157 \text{ ft}^3/\text{day or } 0.8 \text{ gpm}$ $T = Transmissivity (35 ft^2/day)$ i = gradient (0.009)W =width of aquifer suppling flow (500 feet)

Using 0.8 gpm as the underflow in the A aquifer to be captured, a single well pumping 0.8 gpm will have an equilibrium drawdown of 25 feet, which would be substantially below the top of the aquifer and cannot be realized. This means that more than one well will be needed to provide the interception capacity required for hydraulic containment of the plume.

It appears that two wells might provide adequate capacity for hydraulic containment, but a twowell system relies on the assumption that the aquifer is areally infinite and homogeneous. The aquifer testing shows it is neither infinite nor homogeneous. To accommodate the heterogeneities in the A aquifer and to ensure that minimum flows can be maintained, a system of three wells is recommended.

Three pumping well locations were selected to provide hydraulic containment. Existing well NEC22A can be used as an extraction well. One well should be located approximately 80 feet west of monitoring well NEC 8A (Figure A-11). One extraction well should be located within the source area, near NEC1A or NEC26A to provide hydraulic containment at the source area. These locations represent a broad distribution over the site that should accommodate the heterogeneities within the A aquifer while at the same time providing for some flexibility for refining the pumping schemes to potential changes in future conditions (i.e., regional water table changes, variability in flow direction, etc.). The existing monitoring wells can be used for monitoring the performance of the extraction system.





Test performed on March 19, 1996

BECHTEL ENVIRONMENTAL, INC.

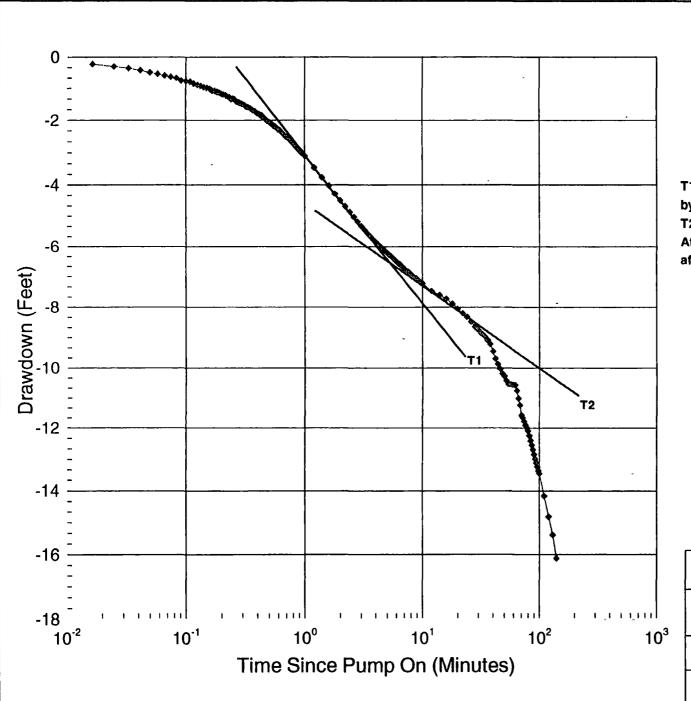
SANFRANCISCO

NEC ELECTRONICS INC. 501 ELLIS STREET MOUNTAIN VIEW, CA

DRAWDOWN VS. TIME IN NEC25A STEP-TEST



Job Number	Drawing No	Rev
17660	FIGURE A-2	



T = 264 x 3 / 8 s T2 = 264 x 3 / 2.7 T2 = 293 gpd/ft or 35 ft²/day

T1 line is drawdown affected
by casing storage.
T2 line is formation yield.
After approximately 40 minutes, drawdown is
affected by impermeable barrier condition.

T = transmissivity

 δs = change in drawdown over one log cycle.

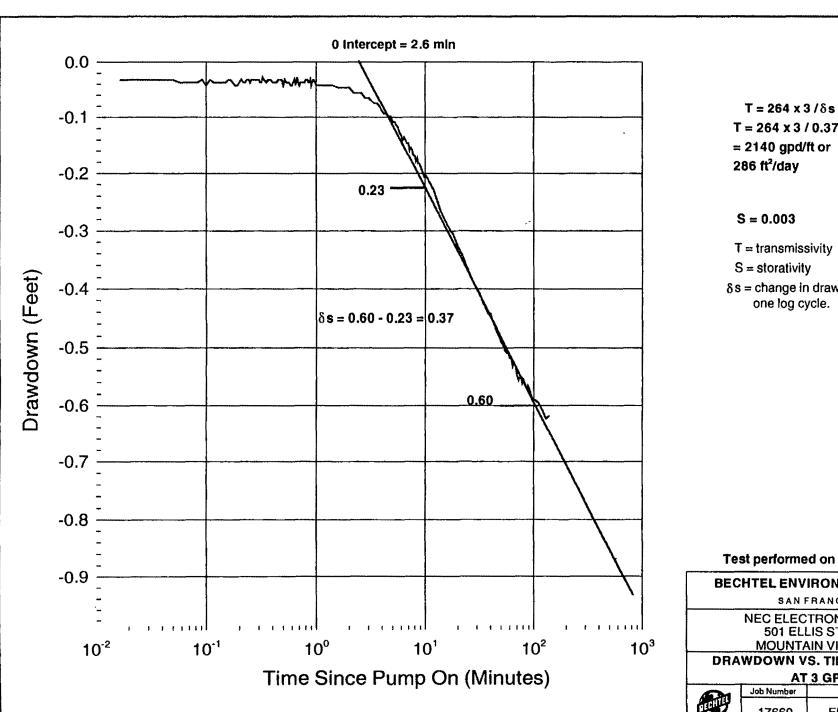
BECHTEL ENVIRONMENTAL, INC.

SAN FRANCISCO

NEC ELECTRONICS INC. 501 ELLIS STREET MOUNTAIN VIEW, CA

DRAWDOWN VS. TIME IN NEC22A AT 3 GPM

Job Number	Drawing No.	Rev.
17660	FIGURE A-3	



 $T = 264 \times 3 / 0.37$

 $\delta s = \text{change in drawdown over}$ one log cycle.

Test performed on March 20, 1996

BECHTEL ENVIRONMENTAL, INC.

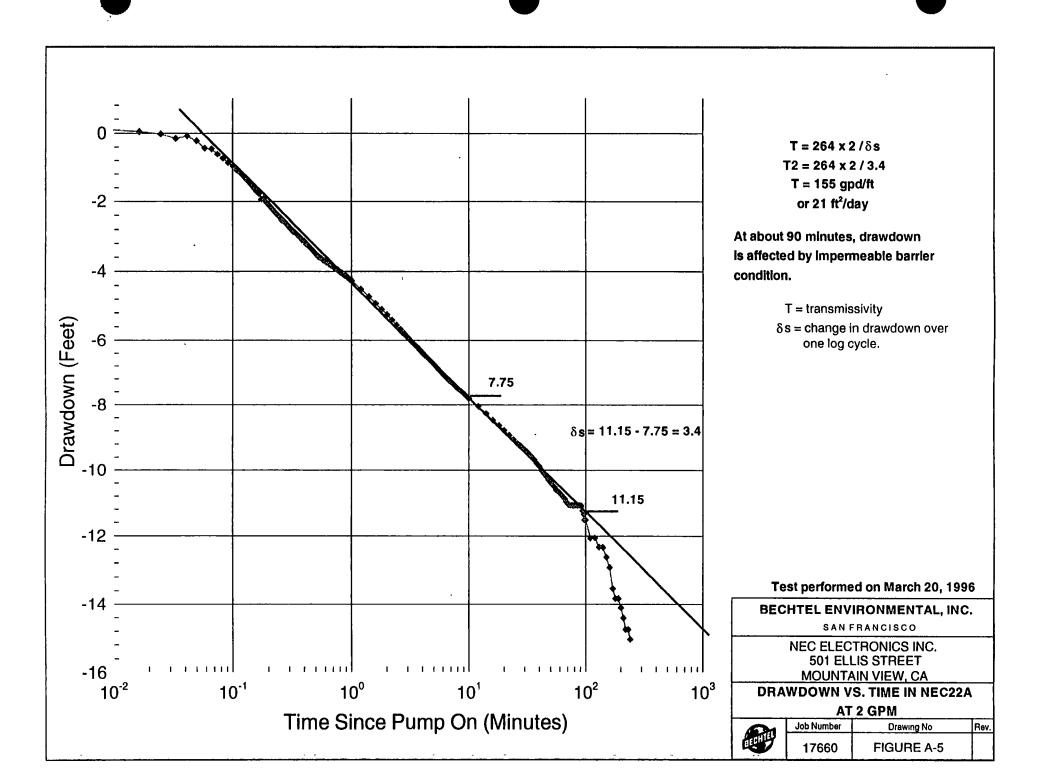
SAN FRANCISCO

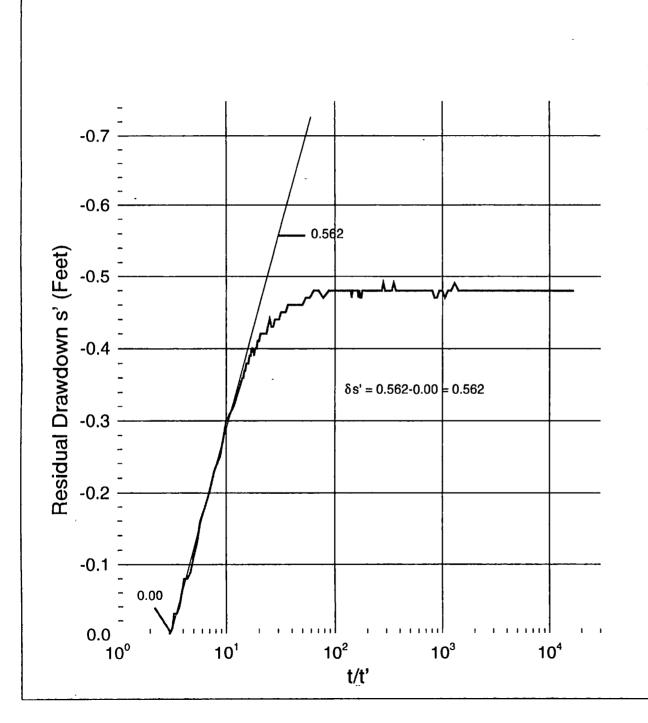
NEC ELECTRONICS INC. **501 ELLIS STREET** MOUNTAIN VIEW, CA

DRAWDOWN VS. TIME IN NEC25A AT 3 GPM

|--|--|

Job Number	Drawing No					
17660	FIGURE A-4					





t = time since pump was turned on in minutes t' = time since pump was turned off in minutes Well NEC25A was pumped for 140 minutes at 3 gpm

T = 264 x 3 / 0.562 = 1409 gpd/ft or 188 ft²/day

T = transmissivity'

 $\delta s' = \text{change in residual drawdown}$ over one log cycle.

Test performed on March 20, 1996

BECHTEL ENVIRONMENTAL, INC.

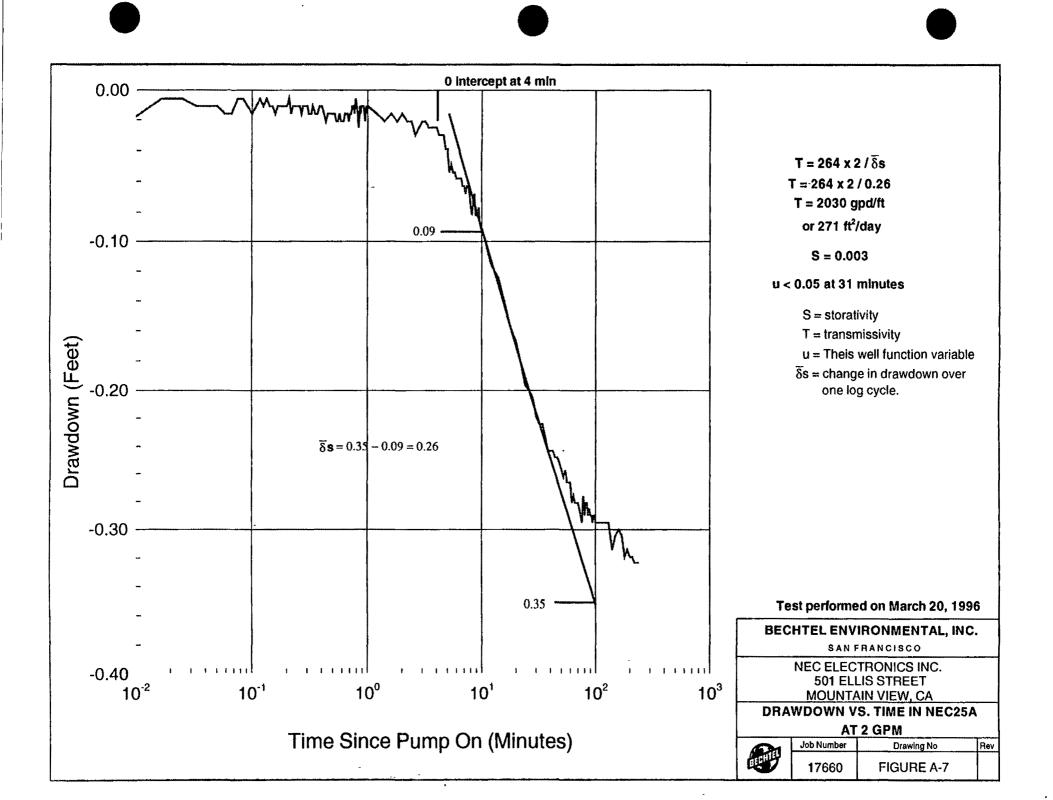
SANFRANCISCO

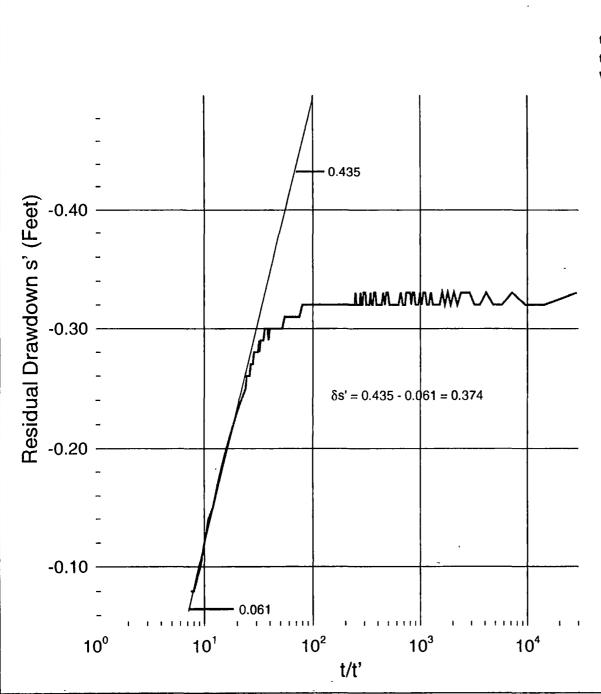
NEC ELECTRONICS INC. 501 ELLIS STREET MOUNTAIN VIEW, CA

RESIDUAL DRAWDOWN VS. V('IN NEC25A - 3 GPM TEST

6	Job Nu
	176

Job Number	Drawing No	Rev
17660	FIGURE A-6	





t = time since pump was turned on in minutes t' = time since pump was turned off in minutes Well NEC22A was pumped for 240 minutes at 2 gpm

> T= 264 x 2 / 0.374 = 1411 gpd/ft or 188 ft²/day

T = transmissivity $\delta s' = change in residual drawdown over one log cycle.$

Test performed on March 20, 1996

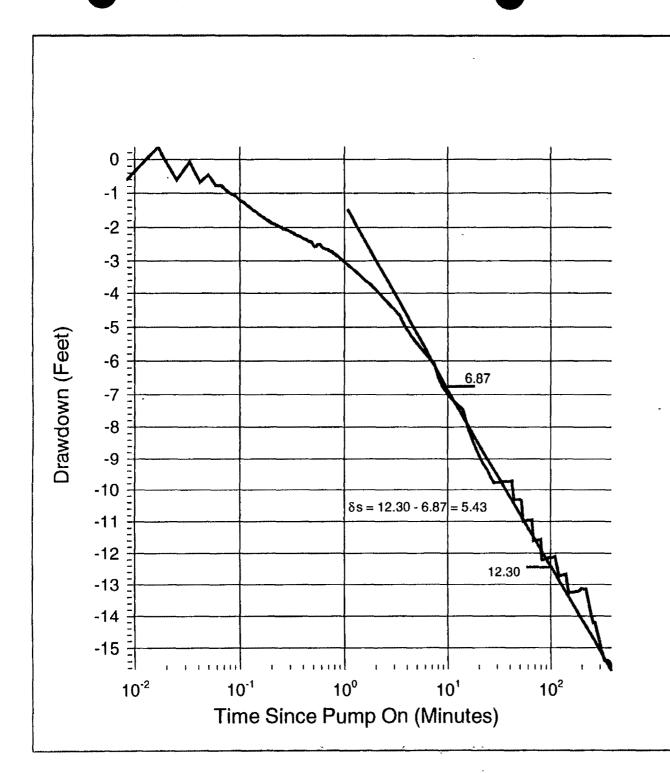
BECHTEL ENVIRONMENTAL, INC.

SAN FRANCISCO

NEC ELECTRONICS INC. 501 ELLIS STREET MOUNTAIN VIEW, CA

RESIDUAL DRAWDOWN VS. V(' IN NEC25A - 2 GPM TEST

634	Job Number	Drawing No.	Re
EHIL	17660	FIGURE A-8	T



T = 264 x 3 / δ s T = 264 x 1 / 5.43 T = 48.6 gpd/ft or 6.5 ft²/day

δs = change in drawdown over one log cycle.

T = transmissivity

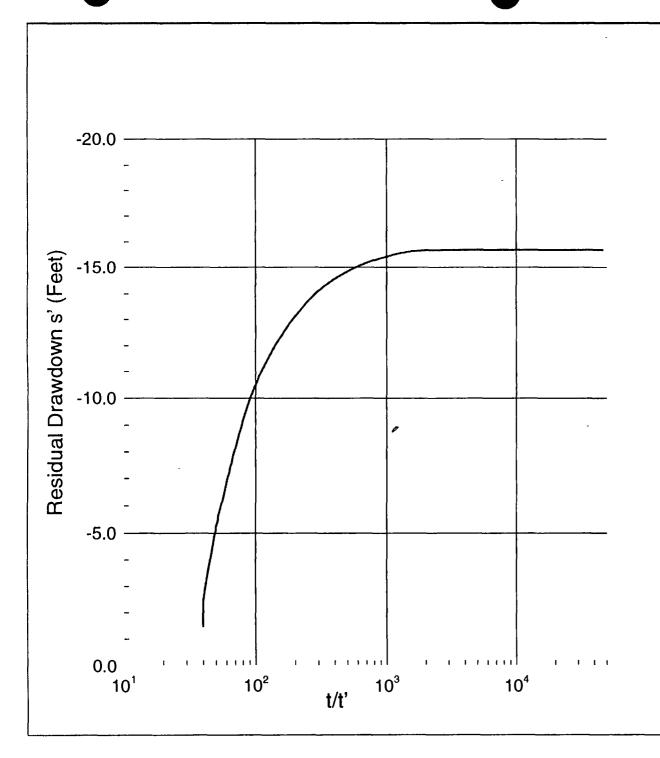
BECHTEL ENVIRONMENTAL, INC.

SAN FRANCISCO

NEC ELECTRONICS INC. 501 ELLIS STREET MOUNTAIN VIEW, CA

DRAWDOWN VS. TIME IN NEC12A AT 1 GPM

	· • • • • • • • • • • • • • • • • • • •	
Job Number	Drawing No.	Aev.
17660	FIGURE A-9	



t = time since pump was turned on in minutes t' = time since pump was turned off in minutes Well NEC12A was pumped for 390 minutes at 1 gpm

Test performed on March 21, 1996

BECHTEL ENVIRONMENTAL, INC.

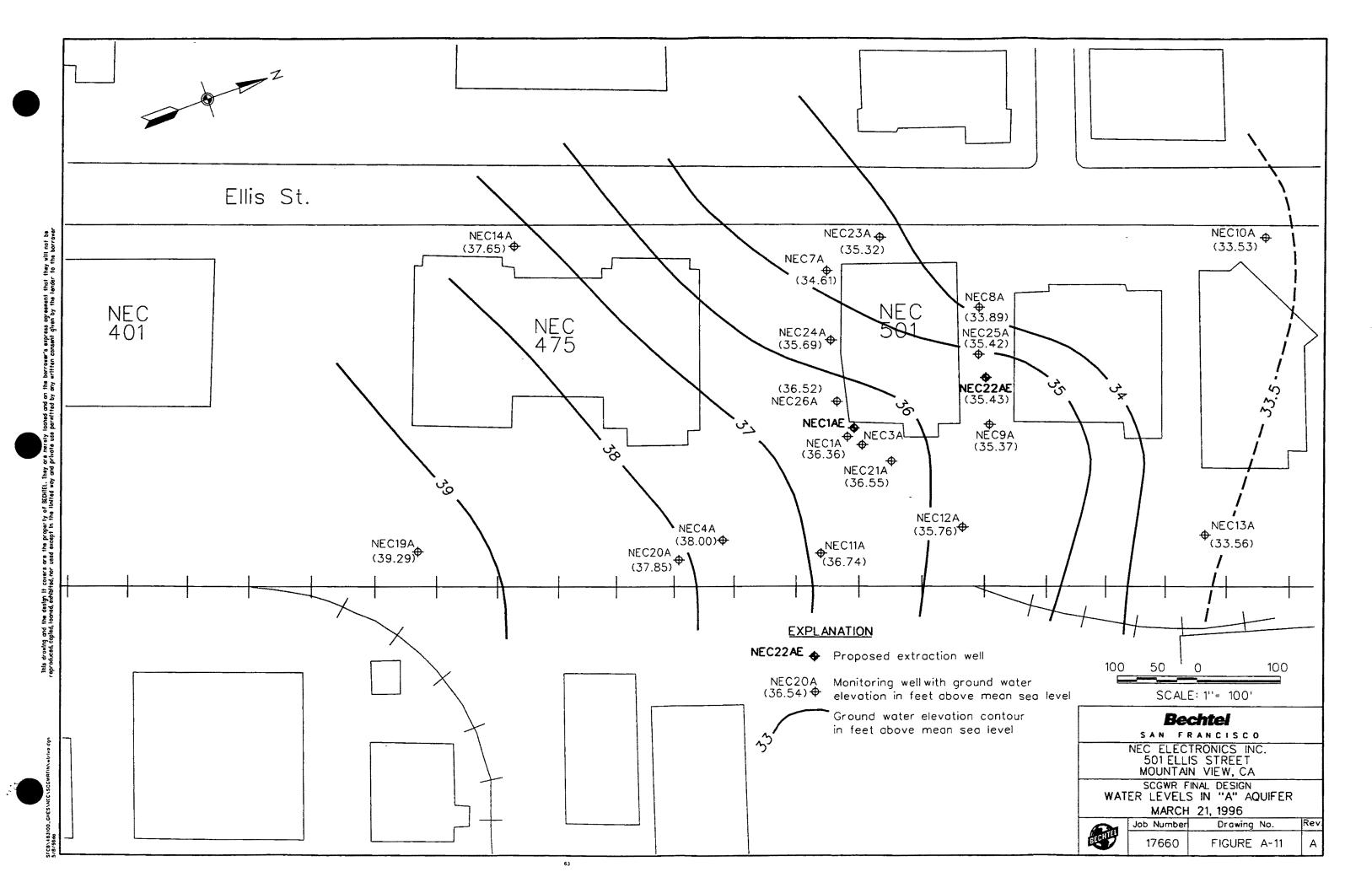
SAN FRANCISCO

NEC ELECTRONICS INC. 501 ELLIS STREET MOUNTAIN VIEW, CA

RESIDUAL DRAWDOWN VS. t/t' IN WELL NEC12A

EME

Job Number	Drawing No.	Rev
17660	FIGURE A-10	



Geologic	al Loc		PROJECT	 T				JOB NO.	HOLE NO.		
and Well	-	NEC - Mountain View			1	NEC25A					
PRILLER		SITE and LOCATION					HOLE DIA.	1 OF 1 BEGUN			
Artesian Enviro	501 Ellis Str					reet	GROUND EL.	3-18-96			
Mobile Drill B6							Matt Janowiak		3-18-96		
HAMMER WEIGHT/FALL 140-Ibs / 30-inch							IA./LENGTH .5-feet	DEPTH/ELEV. GROUND WATER □ 15.0/ □ /	TOTAL DEPTH 30.0	UPDATE 5-20-96	
		4 1	c						(Template	(Template: GEO/MW)	
Well Construction Details Elevation at top of Riser Casing:	Blow Count or Recovery	Sample Type and Number	Elevation in Feet	Depth in Feet	Graphics	Smp /recovery	Descriptio	n and Classification	Notes o Water L Charact Drillin Laborat Testing	evels, er of g and ory	
SURFACE	•				****		0.0 to 0.4 ft ASPHA	LT ark brown silt and sand, trace	Initial advance	ment of	
COMPLETION: Top of riser casing was completed below ground surface, secured with a locking casing plug, and enclosed within				- - 5-			fine to coarse sand plasticity, moist. 1.0 to 6 0 ft SILTY 6	and gravel, moderate CLAY (ML/CL): olive gray, oderate plasticity, moist.	the borehole waccomplished by posthole digger depth of 3.5 ft. probed with a to a depth of 5	by using a r to a then rod . ft.	
a flush-mounted, traffic-rated well box. WELL CASING: Blank riser casing is 4-in dia sch 40 PVC with flush threaded joints. Well screen is 4-in				10-			6.0 to 10.4 ft CLAY increasing clay con moderate to high pl	(CH): light brown, 30-50% silt, tent and moisture with depth, asticity.	borehole was accomplished by truck-mounted equiped with h augers. Soil di were based on cuttings and on collected using split-barrel sam which were ad-	drill ng ollow-stem escriptions drill samples 2-in dia uplers	
Joints. Well screen is 4-in dia sch 40 PVC with 0.020-in transverse machine-cut slots	10	SS		-			10.4 to 15.0 ft SANI iron oxide mottling contact to clayey sa	O WITH SILT (SP): olive with dense, moist. Gradational and at 15 ft.	Ambient air wa monitored at 1 and 0.7 ppm H	ıs % L EL	
and was installed between the depths of 15.5 and 25.5 ft.				-					At 5.5 ft, 1% I 1.8 ppm HNU breathing zone	at hole and	
A 4-ft sump and bottom cap was placed beneath the well screen.				₹ 15- -			15.0 to 17.0 ft CLAY	YEY SAND (SC): olive with dense, moist.	Groundwater encountered at	15 ft.	
				-			17.0 to 18.0 ft CLA				
ANNULAR MATERIALS: 0.0 to 12.5 ft: Cement grout. 12.5 to 14 5 ft: Bentonite pellets.	8 12 18	SS		20- -			18.0 to 22.0 ft CLAY suff.	YEY SILT: light olive brown,	At 18 ft, 0.7 p hole and breatf	om HNU at ning zone.	
14 5 to 30.0 ft: #3 Lonestar sand.	nder en september de la constant de			25-		make a state of the state of th	22.0 to 29.0 ft SILT 60% medium to co gravel, saturated.	Y SAND (SM): light brown, arse sand, 40% silt, trace	At 22 ft, 0 6 p hole and breat		
	10	SS_	-	30-		ar	29.0 to 30.0 ft BLUI and root material, s		At 29 ft, 0 6 p hole and breath Drilling was te at a depth of 3	ning zone rminated	
			SITE a	nd LO	CATI	ON			monitoring we installed HOLE NO.	ll was	

Geologic	al Lo	g	PROJECT	T			JOB NO.	HOLE NO.
and Well			NEC - Mountain View					NEC26A
RILLER					CATIO	SHEET NO. 1 OF 1 HOLE DIA. BEGUN		
	Artesian Enviro					501 Ellis St		10" 3-18-96
RILL MAKE AND MODEL Mobile Drill B6:	1		COORDIA	IATES	and/	or STATIONING	LOGGED BY: Matt Janowiak	GROUND EL. COMPLETED 3-18-96
AMMER WEIGHT/FALL 140-lbs / 30-inch						DIA./LENGTH 9.5-feet	DEPTH/ELEV. GROUND WATER	TOTAL DEPTH UPDATE 19.5 5-20-96
140 103 / 00 11111						7		(Template: GEO/MW)
Blow Count on Details Blow Count on Recovery Sample Type and Number		Elevation in Feet	Depth in Feet	Graphics	Description Description	on and Classificatio	Notes on	
2 2/2			-		*****	0.0 to 0.4 ft ASPH	ALT dark brown silty clay, moderate	Initial advancement of
SURFACE COMPLETION: Top of riser casing was completed below ground surface, secured with a locking casing plug, and enclosed within a flush-mounted, traffic-rated well box. WELL CASING: Blank riser casing is 4-in dia sch 40 PVC with flush threaded joints. Well screen is 4-in dia sch 40 PVC with 0.020-in transverse machine-cut slots and was installed between the depths of 11.0 and 16.0 ft. A 3.5-ft sump and bottom cap was placed beneath the well screen. ANNULAR MATERIALS: 0.0 to 8.0 ft: Cement grout. 8.0 to 10.0 ft: Bentonite pellets. 10.0 to 19.5 ft: #3 Lonestar sand.	456 788	SS		5-		plasticity, stiff, me 2.5 to 11.0 ft SILT brown, trace sand plasticity, moist. 11.0 to 15.0 ft GRA brown, 60% well-silt, loose.	oist. Y CLAY (ML/CL): dark olive and gravel, stiff, moderate AVEL WITH SILT (GP): light rounded gravel, 30% sand, 10% AY (CL): light olive brown with g	the borehole was accomplished by using a posthole digger to a depth of 3.5 ft, then probed with a rod. to a depth of 5 ft. Final advancement of the borehole was accomplished by using a truck-mounted drill rig equiped with bollow-stem augers. Soil descriptions were based on drill cuttings and on samples collected using 2-in dia split-barrel samplers which were advanced with a drop hammer. Ambient air was monitored at 1 % LEL and 0.7 ppm HNU. At 6 ft, 0.7 ppm HNU at hole and breathing zone. At 14 ft, 0 6 ppm HNU at hole and breathing zone. Drilling was terminated at a depth of 19 5 ft and a monitoring well was installed.
			SITE a	nd LC	CATI	on 501 Ellis S	troot	HOLE NO. NEC26A

Table of Contents

Section		<u>Page</u>
B1	INTRODUCTION	B-1
	B1.1 Scope	B-1
	DRAWINGS	
G-001	Site Location	
M-001	Piping and Instrumentation Diagram	
M-002	Treatment Plant Layout	
M-003	Extraction Well Layout	
C-001	SCGWR System Plot Plan	
C-002	Treatment Plant Layout	
C-003	Treatment Plant Sections	
C-004	General Notes and Details	
E-001	Electrical SCGWR System Plot Plan	
E-002	Grounding Power and Lighting	
E-003	Control Details and Schematics	

Drawings

B1 INTRODUCTION

Drawings were prepared by Bechtel Environmental, Inc. (Bechtel) for NEC Electronics Inc. (NEC). These drawings were prepared for the Source Control Groundwater Remediation (SCGWR) Final Design of a groundwater extraction and treatment system at the 501 Ellis Street site. As was noted in the Preliminary SCGWR, the Final Design has been divided into two parts: (1) plans and specifications and (2) procurement. The drawings (plans), specifications, and equipment descriptions comprise a design package which NEC will issue to solicit a qualified Remedial Action Contractor (RAC) during the procurement phase of the project.

B1.1 SCOPE

The design package is intended to provide a RAC with the information necessary to understand the system requirements and to identify, procure, and to install the mechanical equipment required to remediate the site. The design package identifies the requirements for equipment and instrumentation, and describes the basic processes of operation and control, but does not detail all aspects of design, construction, and commissioning. It is the responsibility of the RAC to completely install and connect system equipment and components in accordance with the parameters of the design package, good industrial practices, and the requirements of applicable codes and standards. Any deviation from the requirements or intent of the design package shall be brought to the attention of the Engineer for review.

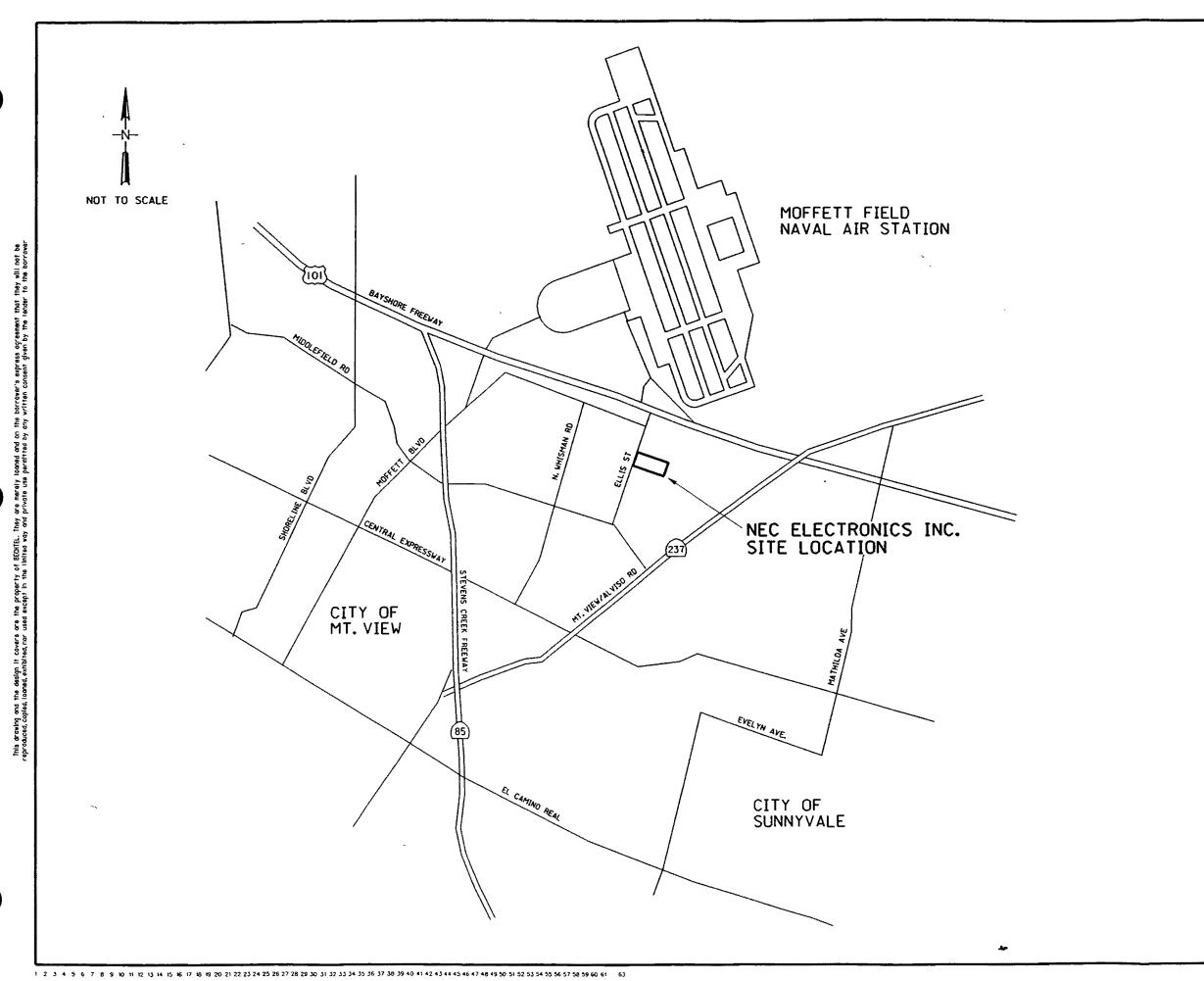
Drawings are diagramatic and are intended to convey scope of work and to indicate general arrangement. They are not intended to show all details, such as offset, fittings, or structural elements that may be required. Except as otherwise indicated, locations of items are approximate only. Exact locations necessary to secure proper conditions and results must be determined at the project site and are the responsibility of the RAC. Except as otherwise indicated, reasonable modifications in layout may be made to prevent conflicts and to ensure proper access and installation.

The design package drawings are divided into four categories, General (G), Mechanical (M), Civil (C) and Electrical (E).

The drawings for the project are shown in the following log:

Drawing Log

Category	Drawing No	Description
General		
	G-001	Site Location
Mechanical		
	M-001	Piping and Instrumentation Diagram
	M-002	Treatment Plant Layout
	M-003	Extraction Well Layout
Civil		
	C-001	SCGWR System Plot Plan
	C-002	Treatment Plant Layout
	C-003	Treatment Plant Sections
	C-004	General Notes and Details
Electrical		
	E-001	Electrical SCGWR System Plot Plan
	E-002	Grounding Power and Lighting
	E-003	Control Details and Schematics



ADDED GAC-101C ISSUED FOR REVIEW No. DATE REVISIONS BY CHKO DESIGN ENGR PROJ APPR SCALE AS SHOWN DESIGNED FL DRAVN RHS

Bechtel

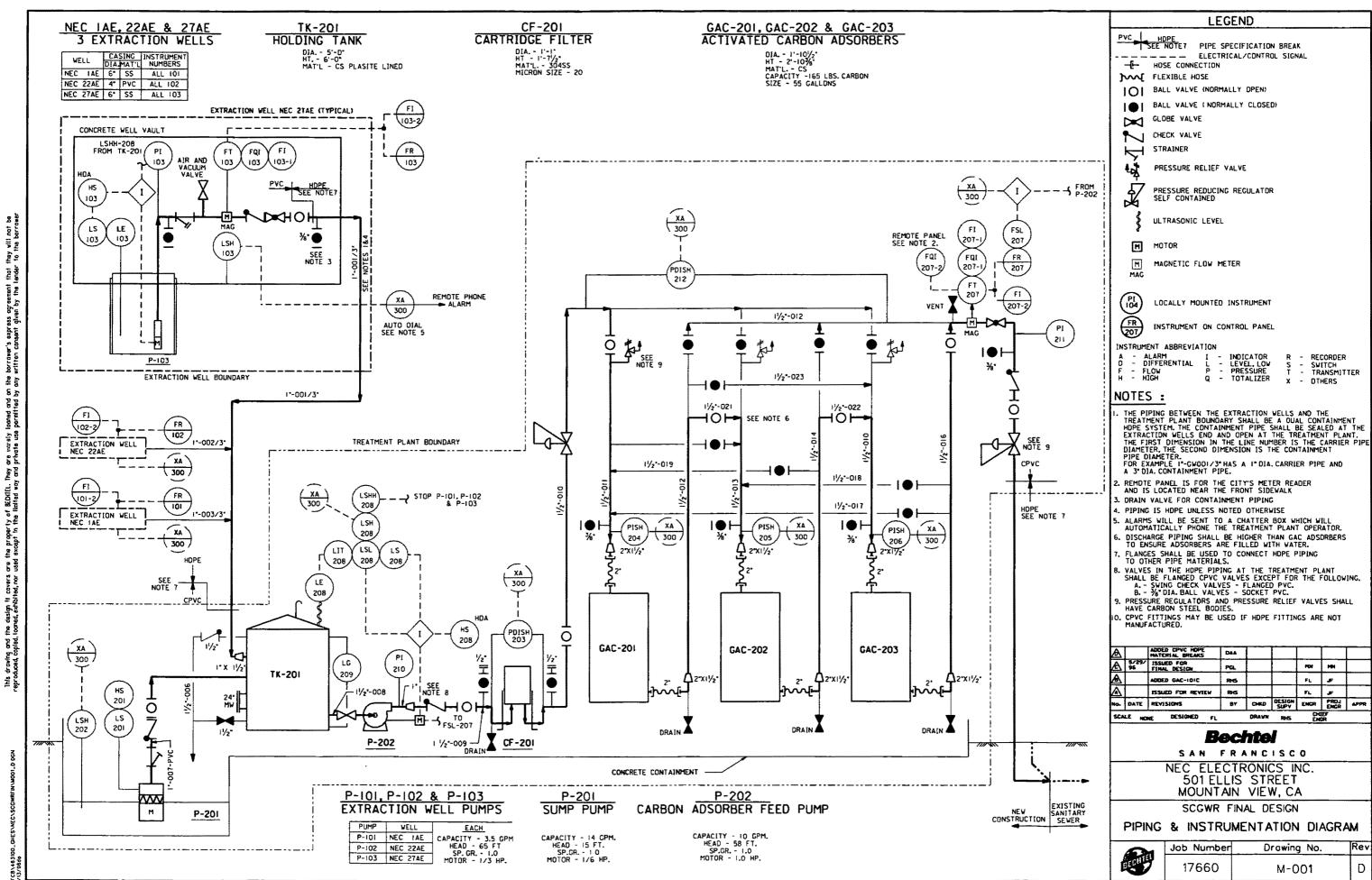
SAN FRANCISCO

NEC ELECTRONICS INC. 501 ELLIS STREET MOUNTAIN VIEW, CA

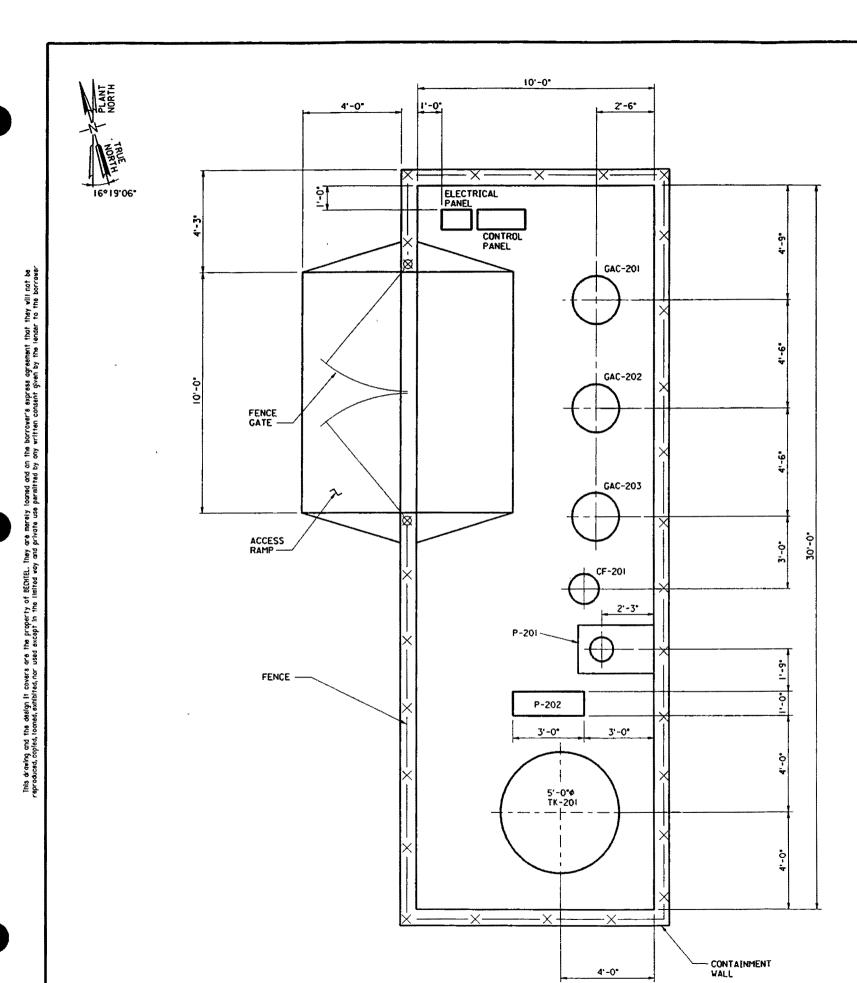
SCGWR FINAL DESIGN SITE LOCATION

634	J
~	

Job Number Drawing No 17660 G-001



Rev



	NUMBER	DESCRIPTION
ı	CF-201	CARTRIDGE FILTER
2	GAC-201	ACTIVATED CARBON ADSORBER - GROUNDWATER
3	GAC-202	ACTIVATED CARBON ADSORBER - GROUNDWATER
4	GAC-203	ACTIVATED CARBON ADSORBER - GROUNDWATER
5	P-201	SUMP PUMP
6	P-202	CARBON ADSORBER FEED PUMP
7	TK-201	HOLDING TANK

SCALE AS SHOWN DESIGNED FL				DRAWN	RHS	EM CH		
Ma.	DATE	REVISIONS	81	CHKO	DESIGN SUPV	EHOR	PROJ	APPR
		ISSUED FOR REVIEW	RMS					
◬	,,,,,	ADDED GAC-101C	RHS					
◬	7/29/qL	FINAL DESIGN	Lan	<u> </u>		MN	MN	

Bechtel

SAN FRANCISCO NEC ELECTRONICS INC. 501 ELLIS STREET MOUNTAIN VIEW, CA

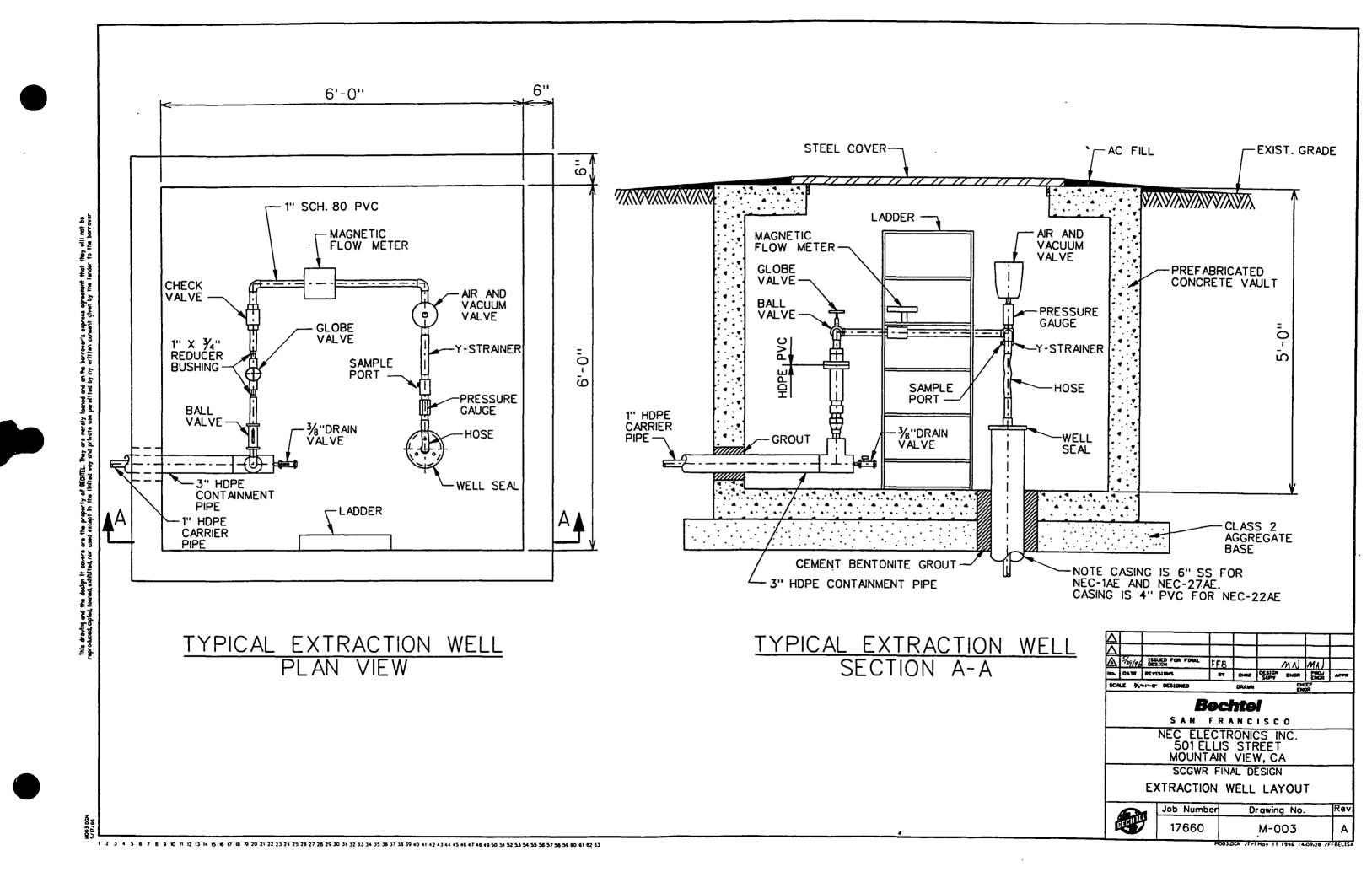
SCGWR FINAL DESIGN

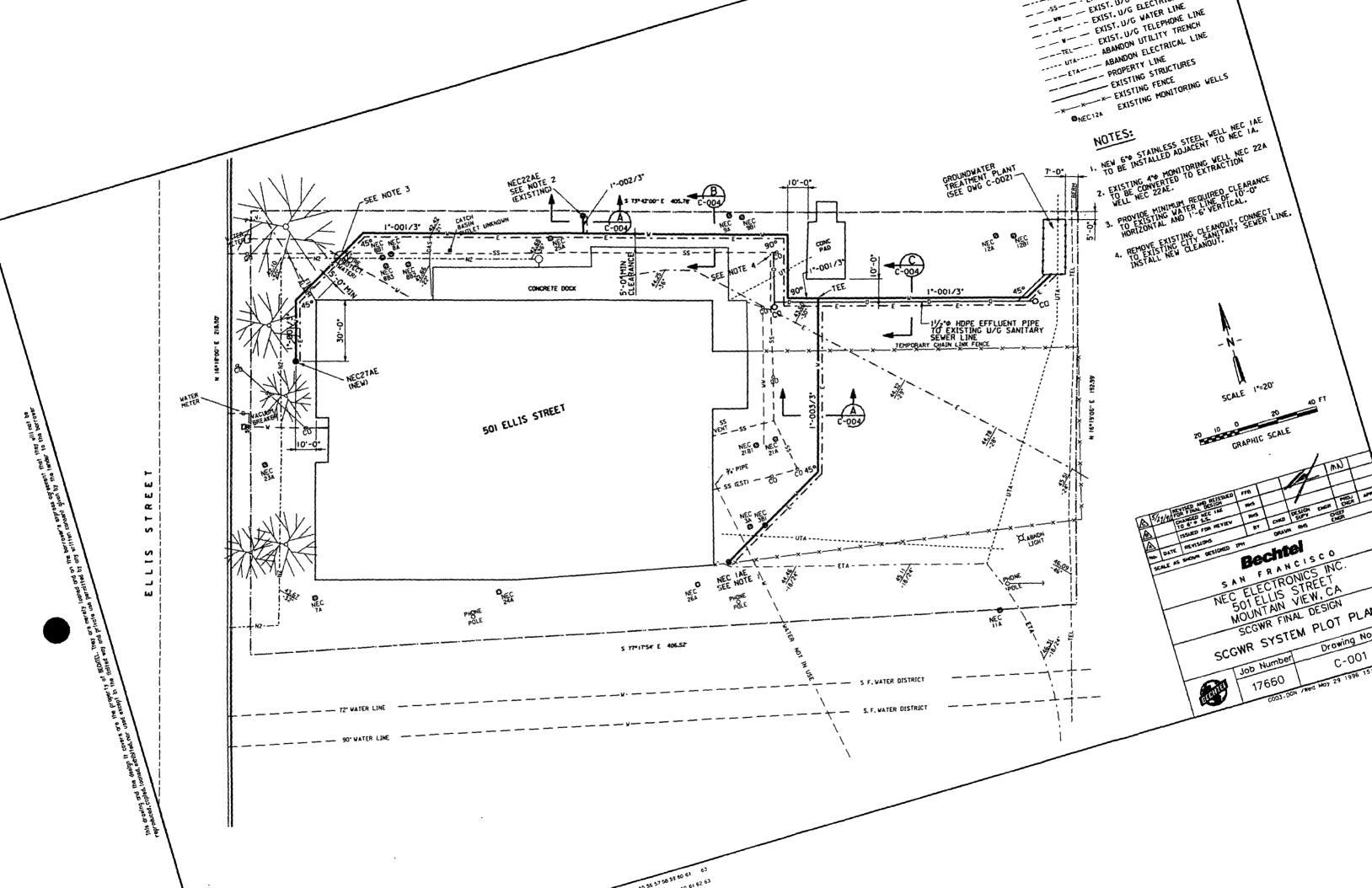
TREATMENT PLANT LAYOUT

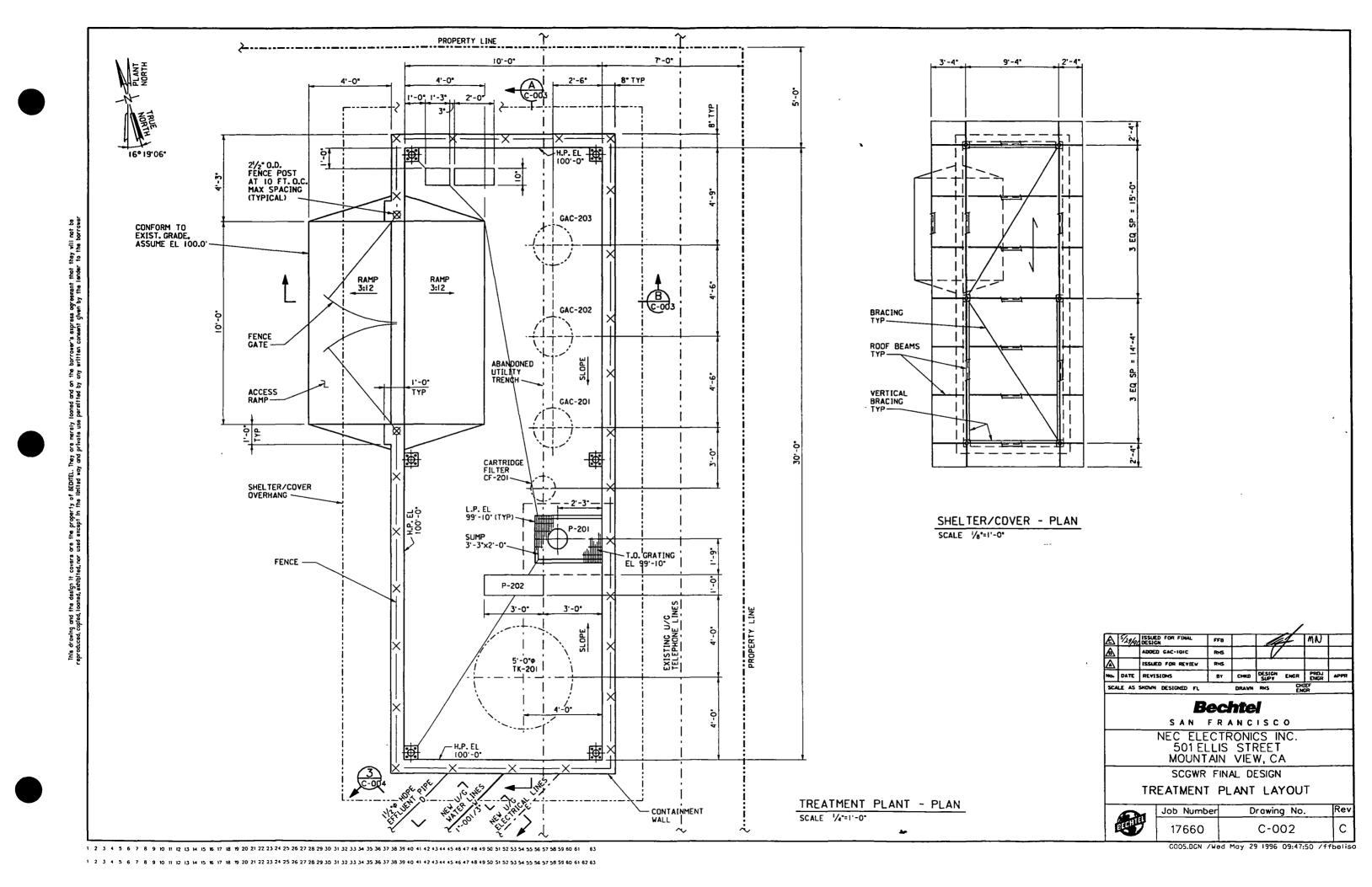
	7

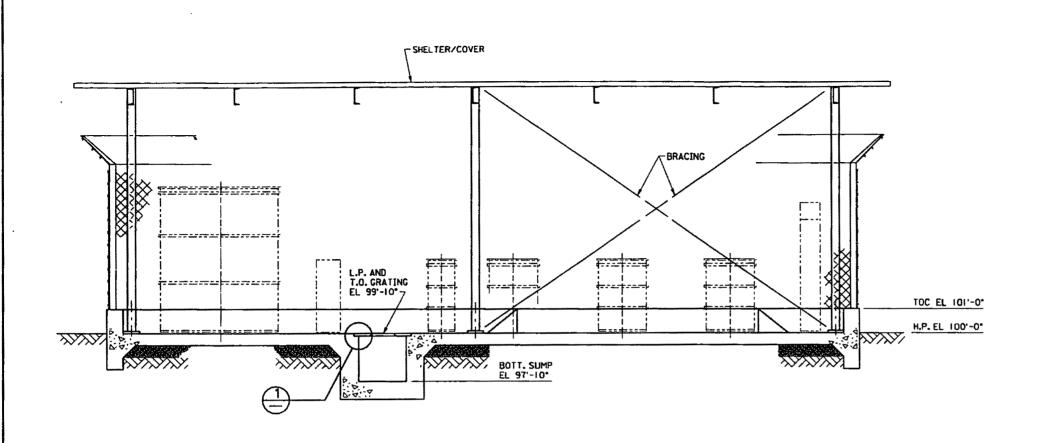
Job Number Drawing No. 17660 M-002

TREATMENT PLANT - PLAN SCALE 1/4"=1"-0"

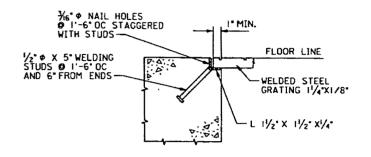




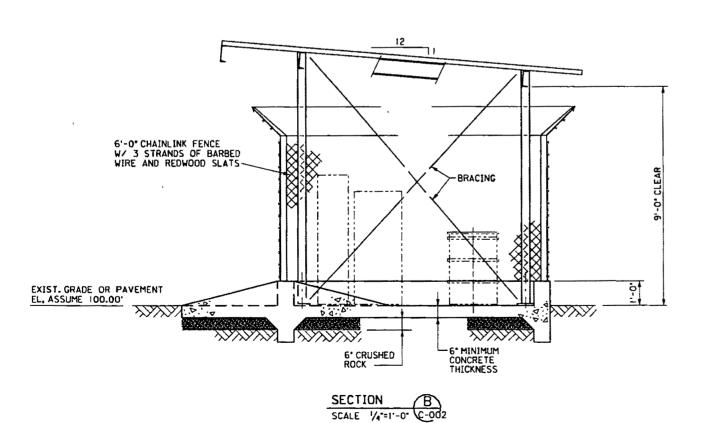




SECTION A C-002



GRATING SUPPORT DETAIL



Δ			1	ļ			Į.
Δ					1		
Δ	4/21/16	ISSUED FOR FINAL DESIGN	FF8		suf	MN	
No.	DATE	REVISIONS	87	CHEED	SUPY ENCR	PROJ DHGR	APPR
SCA	LE AS	SHOWN DESIGNED FL		DRAWN	POIS EN	GEF GR	

Bechtel

SAN FRANCISCO

NEC ELECTRONICS INC. 501 ELLIS STREET MOUNTAIN VIEW, CA

SCGWR FINAL DESIGN TREATMENT PLANT SECTIONS



Job Number	Drawing No.	Rev
17660	C-003	Α

they will to the t

that Inde

borrower's express agreement written consent given by the

t e

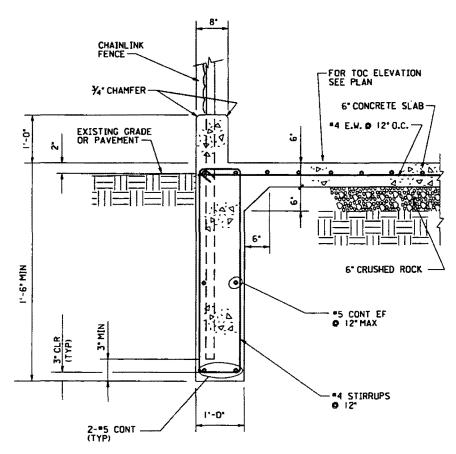
boned and on permitted by a

are merety l

are the property of BEOME used except in the limited

the design it covers loaned, exhibited, nor

- ALL SITE WORK SHALL BE AS INDICATED ON THE DRAWINGS AND IN ACCORDANCE WITH THE SPECIFICATIONS.
- 2. RUBBISH, STUMPS, DEBRIS, STICKS, STONES AND OTHER REFUSE SHALL BE REMOVED FROM THE SITE AND DISPOSED OF LEGALLY.
- 3. THE SITE SHALL BE GRADED TO CAUSE SURFACE WATER TO FLOW AWAY FROM THE EQUIPMENT.
- 4. NO FILL OR EMBANKMENT MATERIAL SHALL BE PLACED ON FROZEN GROUND. FROZEN MATERIALS, SNOW OR ICE SHALL NOT BE PLACED IN ANY FILL OR EMBANKMENT.
- 5. THE SUBGRADE SHALL BE COMPACTED AND BROUGHT TO A SMDOTH UNIFORM GRADE PRIOR TO THE CRUSHED STONE APPLICATION.
- 6. ALL EXISTING ACTIVE SEWER, WATER, GAS, ELECTRIC, AND OTHER UTILITIES WHERE ENCOUNTERED IN THE WORK, SHALL BE PROTECTED AT ALL TIMES, AND WHERE REQUIRED FOR THE PROPER EXECUTION OF THE WORK, SHALL BE RELOCATED AS DIRECTED BY ENGINEERS. EXTREME CAUTION SHOULD BE USED BY THE CONTRACTOR WHEN EXCAVATING OR PIER DRILLING AROUND OR NEAR UTILITIES. CONTRACTOR SHALL PROVIDE SAFETY TRAINING FOR THE
- 7. ALL EXISTING INACTIVE SEWER, WATER, GAS, ELECTRIC AND OTHER UTILITIES, WHICH INTERFERE WITH THE EXECUTION OF THE WORK, SHALL BE REMOVED AND SHALL BE CAPPED, PLUGGED OR OTHERWISE DISCONTINUED AT POINTS WHICH WILL NOT INTERFERE WITH THE EXECUTION OF THE WORK, SUBJECT TO THE APPROVAL OF THE ENGINEER.
- 8. THE AREAS OF THE CUSTOMER'S PROPERTY DISTURBED BY THE WORK AND NOT COVERED BY THE BUILDINGS, PAVEMENT OR GRAVEL, SHALL BE GRADED TO A UNIFORM SLOPE, FERTILIZED, SEEDED, AND COVERED WITH MULCH. ALL OTHER DISTURBED AREAS SHALL BE REPLACED WITH MATERIAL EQUAL TO



EQUIPMENT PAD/SLAB ON GRADE

DETAIL NTS

STANDARD STRUCTURAL STEEL NOTES:

- 2. STRUCTURAL TUBING MEMBERS SHALL CONFORM TO ASTM A500, GRADE A

- 6. NON-STRUCTURAL CONNECTIONS FOR HANDRAIL, LADDERS AND STEEL GRATING MAY USE % DIA GALVANIZED ASTM A 307 BOLTS UNLESS NOTED OTHERWISE.

STANDARD CONCRETE AND REINFORCING BAR NOTES:

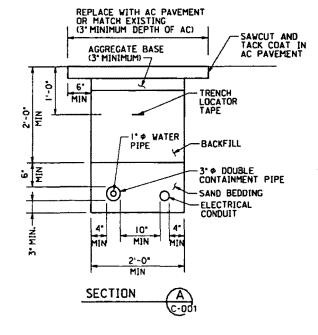
- ALL CONCRETE WORK SHALL BE IN ACCORDANCE WITH ACI 301-89. ACI 318-95 AND SPECIFICATION CAST-IN-PLACE CONCRETE.
- 2. ALL CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF REINFORCING STEEL UNLESS SHOWN OTHERWISE ON DRAWINGS:

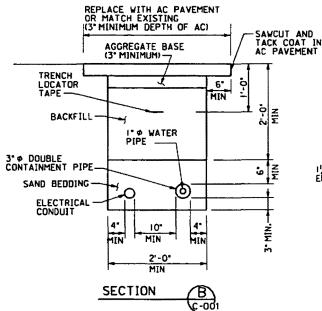
CONCRETE CAST AGAINST EARTH.................................. IN. CONCRETE EXPOSED TO EARTH OR WEATHER: *6 AND LARGER II. IN. IN.

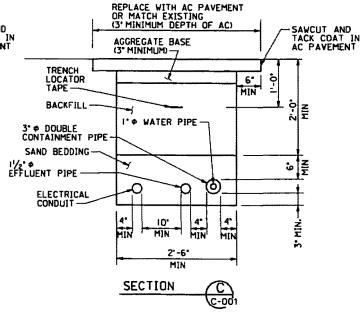
CONCRETE NOT EXPOSED TO EARTH OR WEATHER OR NOT CAST AGAINST THE GROUND:

SLAB AND VALL BEAMS AND COLUMNS.

- 3. A CHAMFER ¾ SHALL BE PROVIDED AT ALL EXPOSED EDGES OF CONCRETE UND IN ACCORDANCE WITH ACI 301 SECTION 4.2.4.
- 4. INSTALLATION OF CONCRETE EXPANSION/WEDGE ANCHOR, SHALL BE PER MANUFACTURER WRITTEN RECOMMENDED PROCEDURES.







A S/25/41 ISSUED FOR FINAL DESIGN FFE PROJ EMGR No. DATE REVISIONS 57 EMGR SCALE AS SHOWN DESIGNED FL

Bechtel SAN FRANCISCO

NEC ELECTRONICS INC. 501 ELLIS STREET MOUNTAIN VIEW, CA

SCGWR FINAL DESIGN

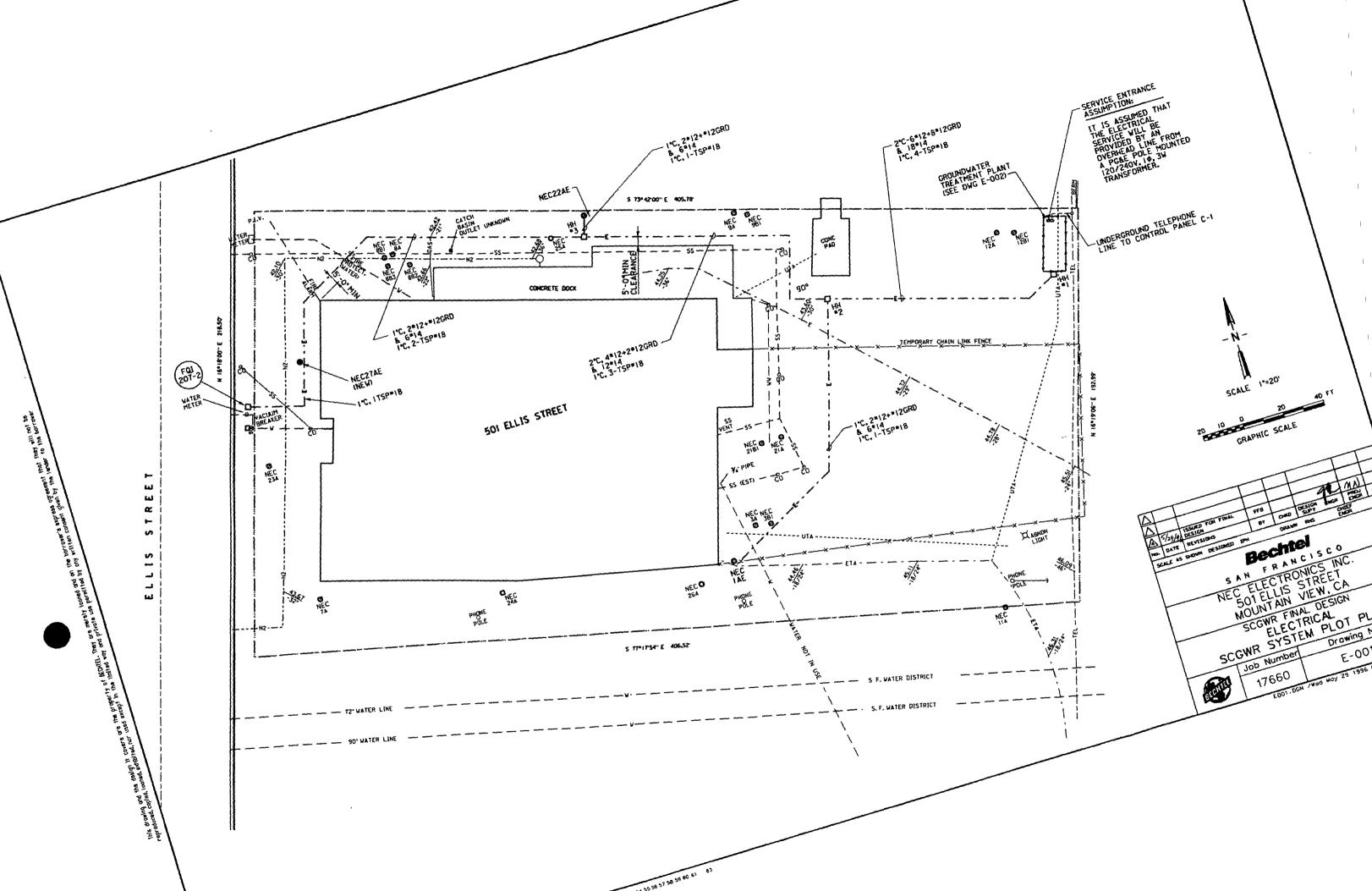
GENERAL NOTES AND DETAILS

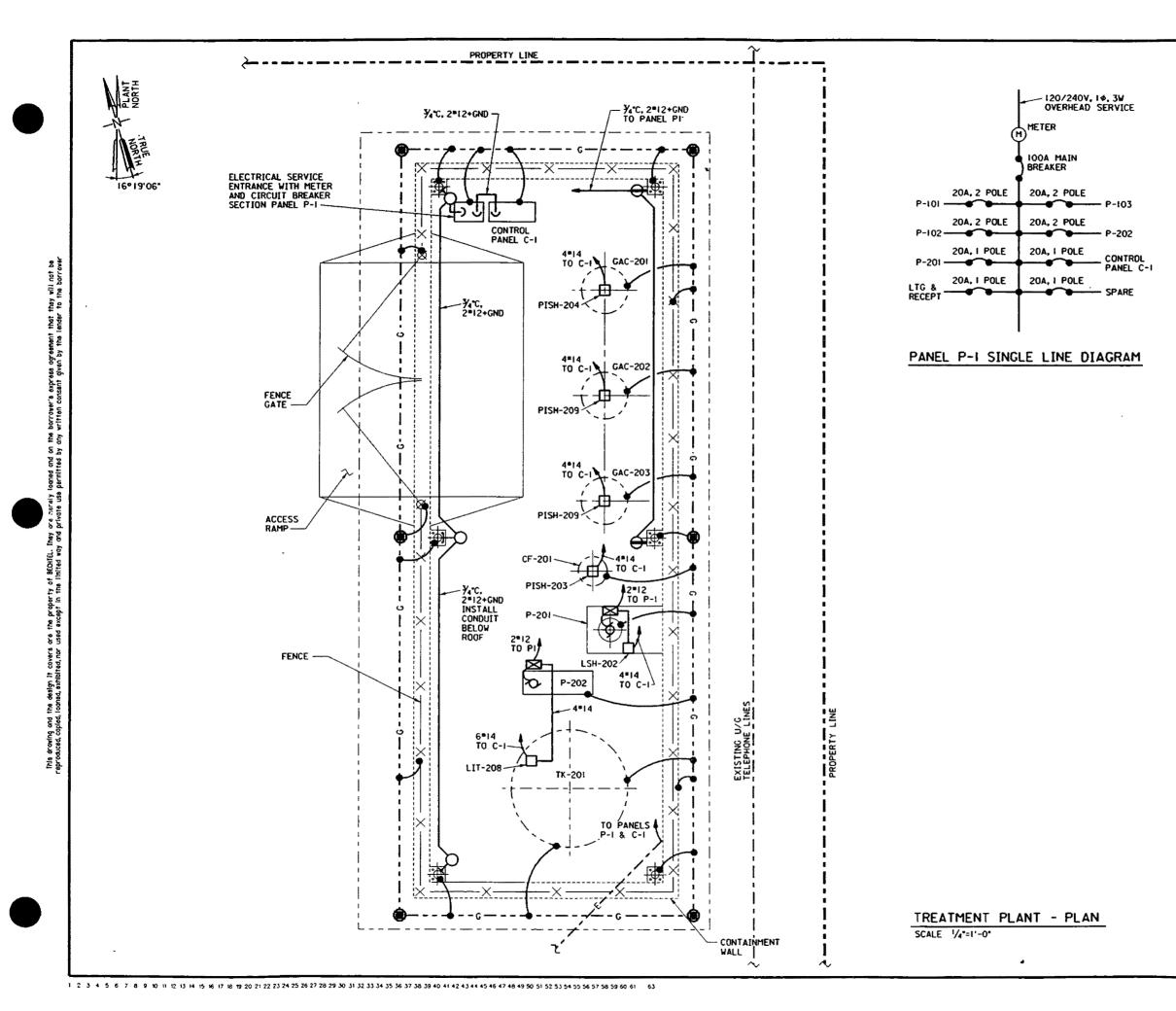


Re۱ Job Number Drawing No. 17660 C-004

G007.0GN /Wed May 29 1996 15:19:48 /PGL0GIN0

- ALL METAL WORK SHALL BE IN ACCORDANCE WITH SPECIFICATION GALVANIZED ASTM A36 UNLESS NOTED OTHERWISE.
- 3. ALL WELDING SHALL BE DONE USING ETOXX ELECTRODES AND WELDING SHALL CONFORM TO AISC AND AWS DI.I. WHERE FILLET WELD SIZES ARE NOT SHOWN, PROVIDE THE MINIMUM SIZE PER TABLE J2.4 IN THE AISC THANUAL OF STEEL CONSTRUCTION, 9TH EDITION.
- 4. BOLTED CONNECTIONS SHALL USE BEARING TYPE GALVANIZED ASTM A325 BOLTS (% DIA) AND SHALL HAVE A MINIMUM OF TWO BOLTS UNLESS NOTED OTHERWISE.
- 5. BEAM CONNECTIONS SHALL BE DESIGNED FOR COMBINATION AXIAL, HORIZONTAL AND VERTICAL FORCES INDICATED ON PLANS. IF BEAM REACTION ARE NOT SHOWN, THE MINIMUM VERTICAL DESIGN FORCE SHALL BE ONE HALF THE TOTAL UNIFORM LOAD CAPACITY OF THE





LEGEND

(

GROUND ROD

- c-

EARTH ELECTRODE GROUND LOOP *4/0 BC

BONDING JUMPER

· ELEC

ELECTRICAL UNDERGROUND DUCT BANK

□HH

ELECTRICAL HAND HOLE 12"x14"x18" DEEP (APPROX) BROOKS OR EQUAL

Ю

INCANDESCENT LIGHT FIXTURE, APPLETON TYPE REA. 150W, WITH WALL BRACKET & ALUMINUM GUARD, PANEL SWITCHED

- O

GFI TYPE DUPLEX RECEPTACLE



MOTOR STARTER

NOTES:

I. ALL WIRING TO MOTORS & INSTRUMENTS SHALL BE INSTALLED IN CONDUIT ABOVE THE PIPE SUPPORTS.

A 5/29/3 ISSUED FOR FINAL LAN GESTON BURG PROJ APPR

NO. DATE REVISIONS BY CHILD DESIGN BURG PROJ APPR

SCALE AS SHOWN DESIGNED FL DRAIM RMS CHIEF

Bechtel

SAN FRANCISCO

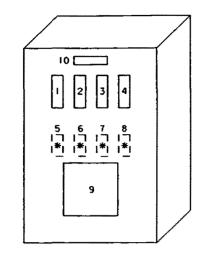
NEC ELECTRONICS INC. 501 ELLIS STREET MOUNTAIN VIEW, CA

SCGWR FINAL DESIGN

GROUNDING POWER AND LIGHTING



Job Number	Drawing No	Rev
17660	E-002	Α



6 FR - 102 7 FR - 103

NAME PLATE LEGEND

I FI - 101-2

2 FI - 102-2 3 FI - 103-2

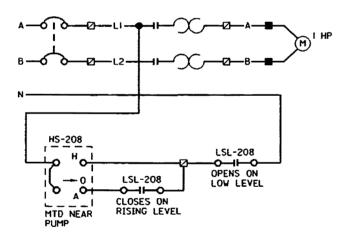
4 FI - 207-2 5 FR - 101

9 XA - 300 10 CONTROL PANEL

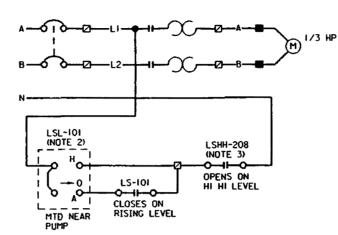
8 FR - 207

* ITEMS ARE REAR PANEL MOUNTED

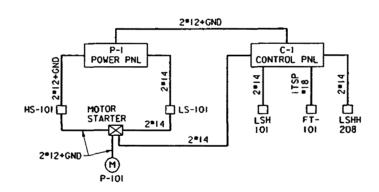
CONTROL PANEL - FRONT VIEW
HOFFMAN CATALOG No. A-36R2412HCR



CARBON ADSORBER FEED PUMP P-202 SCHEME P-202



EXTRACTION WELL NEC TAE



WELL NEC TAE BLOCK DIAGRAM

(TYPICAL FOR NEC 22AE & NEC 27AE)

NOTES:

ADAPTER TABLE

HS-101

HS-102 LS-102

PUMP

P-101

NEC 27AE P-103 HS-103 LS-103

WELL No.

NEC IAE

NEC 22AE P-102

LEVEL SW No.

LS-101

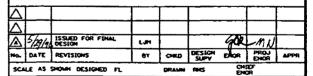
TK-201 HI HI LEVEL SW

LS HH-208

- ALL FIELD INSTRUMENTS REQUIRING EXTERNAL 120 Voc POWER SHALL BE SUPPLIED FROM CONTROL PANEL.
- 2. HS-101,102 & 103 ARE LOCALLY MOUNTED AT EACH RESPECTIVE WELL.
- 3. LSHH-208 HI H2 LEVEL SIGNAL MULTI PLYING RELAY MTD IN CONTROL PANEL.

LEGEND:

- ZI TERMINAL AT LOCALLY MOUNTED STARTER
- TERMINAL AT STARTER
- O TERMINAL AT LOCAL SWITCH/ INSTRUMENT



Bechtel

SAN FRANCISCO

NEC ELECTRONICS INC. 501 ELLIS STREET MOUNTAIN VIEW, CA

SCGWR FINAL DESIGN

CONTROL DETAILS AND SCHEMATICS



Job Number	Drawing No.	Rev
17660	E-003	Α

Appendix C

Table of Contents

<u>Section</u>		<u>Page</u>
C1	INTRODUCTION	C-1
	C1.1 Scope	C-1
C2	Equipment List	C-2
C3	Catalog Cuts	
	Section I - Extraction Wells NEC1AE, NEC22AE, and NEC27AE	C-I-1
	Section II - Unnumbered Extraction Well Equipment	C-II-1
	Section III - Treatment Plant Equipment	C-III-1
	Section IV - Unnumbered Treatment Plant Equipment	C-IV-1
	Section V - Extraction Well and Treatment Plant Equipment	C-V-1

Introduction

An equipment list and catalog cuts were prepared to describe the SCGWR Final Design equipment for the 501 Ellis Street site. As was noted in Appendix B, the equipment descriptions comprise a portion of the design package which NEC will issue to solicit a qualified Remedial Action Contractor (RAC) during the procurement phase of the project. The equipment list and catalog cuts identify typical equipment and instrumentation that accomplishes the basic processes of operation and control but does not detail all aspects of design, construction, and commissioning. It is the responsibility of the RAC to completely install and connect system equipment and components in accordance with the parameters of the design package, good industrial practices, and the requirements of applicable codes and standards. Alternative equipment may be substituted for the equipment described in the equipment list if the Engineer agrees that the substituted equipment is equal or better than the original equipment.

C1.1 SCOPE

The equipment list and catalog cuts were divided into the following five sections:

Section I - Extraction Wells NEC1AE, NEC22AE, and NEC27AE

Section II - Unnumbered Extraction Well Equipment

Section III - Treatment Plant Equipment

Section IV - Unnumbered Treatment Plant Equipment

Section V - Extraction Well and Treatment Plant Equipment

The equipment sections are associated with a physical location. Sections I and II describe equipment located at the extraction wells. Sections III and IV describe equipment located at the groundwater treatment plant. Section V describes equipment that is in both locations. The equipment was further divided into (Sections I and III) which contain equipment with P&ID equipment numbers and sections (Section II and IV) which have no P&ID equipment numbers.

Equipment lists and catalog cuts are also included in Appendix C.

EQUIPMENT LIST - NEC -501 ELLIS STREET SECTION I - EXTRACTION WELLS NEC1AE, 22AE, AND 27AE

ITEM	EQUIPMENT	EQUIPMENT	QUAN.	DESCRIPTION/TYPE	MOTOR
	NO.	NAME			HP
1	101-1, FI- 102-1, 103-1	Flow Indicator	3	4-digit local LCD flow rate indicator, provided with the magnetic flowmeter, see FT-101, FT-102, FT-103.	
2	101-2, FI- 102-2, 103-2	Flow Indicator	3	eschler BG-252 Single Bar Graph with LED display	
3	101, FQI- 102, 103	Flow Totalizer	3	8-digit local totalizer provided with the magnetic flowmeter, see FT-101, FT-102, FT-103.	
4	101, FR- 102, 103	Flow Recorder	3	loore Industries Data Recorder Module (DRM) with the Data Transfer Module (DTM) and oftware for downloading. Data stored in digital form, down loaded by DTM and software or use by a personal computer.	
5	101, FT- 102, 103	Extraction Well Flow Meter and Transmitter		Electromagnetic flowmeter, Sparling Instrument Co., Model 621 1-inch diameter, NEMA 4X, flangeless connection, 316 stainless steel electrodes, 8 digit totalizer, 4 digit flow rate indicator, 4-20 mA and 24 V dc outputs.	
6	101, HS- 102, 103	Hand Switch	3	Allen Bradley 3 position selector switch/non-illuminated (800EM HL32CI and 800E-2L x20E) in NEMA 4X enclosure.	
7	101, LE- 102, 103	Level Probes	3	Included with LS-101, LS-102, LS-103	
8	101, LS- 102, 103	Level Switches	3	Magnetrol Sentinel capacitance level switches with 30 ft flexible probe, two adjustable deadband DPDT relays, operator-programmable, 120 VAC	
9	101, P- 102, 103	Extraction Well Pump	3	Grundfos Redi-Flo4 - Submersible pump for environmental applications, model 5E, 304 stainless steel, flow rate 3.5 gpm, head -65 ft.	
10	101, PI- 102, 103	Pressure Gauge	3	Control System Specialists, Acragage 1500 series process gauge, 4.5 in. phenolic case, 1/2" lower mount, glycerin filled case, scale 0-60 psig	

EQUIPMENT LIST - NEC -501 ELLIS STREET SECTION II - UNNUMBERED EXTRACTION WELL EQUIPMENT

ITEM	EQUIPMENT NO.	EQUIPMENT NAME	QUAN.	DESCRIPTION/TYPE	MOTOR HP
1	NA	Air and Vacuum Valves	3	Air and Vacuum Valves, APCO model 141, 1-inch NPT inlet and outlet connections	
2	NA	Ball Valves		True Union Ball Valves, Harrington part number BV10100S, 1-inch diameter, socket inlet and outlet connections.	
3	NA	Check Valves		Spring Check Valves, Harrington part number 1011-10FL, 1-inch socket inlet and outlet connections.	
4	NA	Concrete Vaults	3	Utility Vault Co., Prefabricated concrete vaults with a concrete base, 6 foot W x 6 foot L x 5 foot D, with traffic rated adjustable frame cover No. 4848.	
5	NA	Discharge Piping	Lot	1" -Diameter Schedule 80 PVC pipe and 1" Diameter HDPE pipe	
6	NA	Drain Valves for Dual Containment	3	True Union Ball Valves, Harrington part number BV10037S, 3/8-inch diameter, socket inlet and outlet connections.	
7	NA	Globe Valves	3	Fisher-Porter Valves, Design EZ Micro-Form Valve Plug, 3/4-inch body, 3/4-inch port dia., 3/4-inch NPT, manual actuator.	
8	NA	Hose	Lot	Ryan Herco Herco-Flex wire-reinforced PVC tubing, 1-inch diameter, length - 10 feet	
9	NA	Magnetic Flow Meters	3	Electromagnetic flowmeter, Sparling Instrument Co., Model 621 1-inch diameter, NEMA 4X, flangeless connection, 316 stainless steel electrodes, 8 digit totalizer, 4 digit flow rate indicator, 4-20 mA and 24 V dc outputs.	
10	NA	Motor Starters	1	Motor circuit protector type with instantaneous-only trip circuit breaker and separate overload device, one thermal overload relay per phase, 2 N.O. and 2 N. C. spare contacts in NEMA 3R enclosure for well pumps (220V, 1 phase, 1/3 HP)	
11	NA	Sample Ports	3	Whitey Number 43F4, 1/4" diameter, FNPT inlet and outlet connections, 316 stainless steel body and stem	
12	NA	Well Casing NEC-1AE	1	6-inch diameter PVC casing, length approximately 31 feet	
13	NA	Well Casing NEC-27AE	1	6-inch diameter PVC casing, length approximately 31 feet	
14	NA	Well Casing NEC-22AE	1	Existing 4-inch diameter schedule 40 PVC casing, length approximately 31 feet	
15	NA	Well Seals	3	Grundfos stainless steel well seals, compression connection, center opening for 1-inch dia. schedule 80 PVC discharge pipe. Three additional openings for power and control wires and a level sensor. One 4- inch diameter and two 6-inch diameter seals.	

EQUIPMENT LIST - NEC -501 ELLIS STREET SECTION II - UNNUMBERED EXTRACTION WELL EQUIPMENT - CONTINUED

ITEM	EQUIPMENT NO.	EQUIPMENT NAME	QUAN.	DESCRIPTION/TYPE	MOTOR HP
16	, NA	Y-Strainers	1 1	Ryan Herco Y-Strainers, 1-inch diameter, PVC socket connection, 316 stainless steel screens with 1/32" perforations.	

EQUIPMENT LIST - NEC -501 ELLIS STREET SECTION III - TREATMENT PLANT EQUIPMENT

ITEM	EQUIPMENT NO.	EQUIPMENT NAME	QUAN.	DESCRIPTION/TYPE	MOTOR HP
1	CF- 201	Cartridge Filter	l	Harmsco Industrial Filter, Model HIF-7, stainless steel body, PVC standpipes, CPVC cartridge holders, 7 cartridges, 20 micron opening	
2	FI- 207-1	Effluent Flow Indicator	1	4-digit local LCD flow rate indicator, provided with the magnetic flowmeter, see FT-207.	
3	FI- 207-2	Effluent Flow	1	Weschler BG-252 Single Bar Graph with LED display	
4	FQI- 207-1	Effluent Flow Totalizer	1	8-digit local totalizer provided with the magnetic flowmeter, see FT-207.	
5	FQI- 207-2	Effluent Flow Totalizer	ı	Sparling Flow Totalizer No. 1T787-2, 8 digit, electric reset, NEMA 4 enclosure,	
6	FR- 207	Effluent Flow Recorder	1	Moore Industries Data Recorder Module (DRM) with the Data Transfer Module (DTM) an software for downloading. Data stored in digital form, down loaded by DTM and software for use by a personal computer.	
7	FSL- 207	Low Effluent Flow Switch	1	Included with FR-207	
8	FT- 207	Effluent Flow Meter and Transmitter	1	Electromagnetic flowmeter, Sparling Instrument Co., Model 621 1-inch diameter, NEMA 4X, flangeless connection, 316 stainless steel electrodes, 8 digit totalizer, 4 digit flow rate indicator, 4-20 mA and 24 V dc outputs.	
9	201, GAC- 202, 203	Activated Carbon Adsorber - Groundwater	3	Calgon, FlowSorb, 55 gallon carbon steel canister with phenolic epoxy lining, diameter - 24 inches-nominal, carbon fill 165 lbs of Filtrasorb 300, inlet and outlet connection 2 inch FNPT, maximum pressure 15 psig.	
10	HS- 201	Sump Pump Hand Switch	1	Included with P-201	
11	HS- 208	Adsorber Feed Pump Selector	1	Allen Bradley 3 position selector switch/non-illuminated (800EM HL32CI and 800E-2L x20E) in NEMA 4X enclosure.	
12	LE- 208 LIT- 208	Holding Tank Level	1	Milltronic Multiranger Plus Ultrasonic level measurement system. Ultrasonic transducer, 4 character LCDs display, NEMA 4 enclosure.	
13	LG- 209	Tank Level Gauge	1	Jerguson Model VA-902 tubular sight glass gauge, 54" visible length, brass gauge valves, tempered glass with heavy-duty enclosure around gauge glass.	
14	LS- 201	Sump Pump Level Switch	1	Included with P-201	
15	LS- 208	Pump Level Switch	1	Included with LE-208 and LIT-208	

EQUIPMENT LIST - NEC -501 ELLIS STREET

SECTION III - TREATMENT PLANT EQUIPMENT - CONTINUED

ITEM	EQUIPMENT NO.	EQUIPMENT NAME	QUAN.	DESCRIPTION/TYPE	MOTOR HP
16	LSH- 202	Flood Level Switch	1	Magnetrol Flood Level Switch, Switch Housing NEMA 4X, stainless steel float	
17	LSH- 208	High Level Pump Switch	1	ncluded with LE-208 and LIT-208	
18	LSHH- 208	High High Level Pump Switch	1	ncluded with LE-208 and LIT-208	
19	LSL- 208	Low Level Pump Switch	1	Included with LE-208 and LIT-208	
20	P- 201	Sump Pump	1	Little Giant Submersible Utility Dewatering Pump, Model 5-ASP, pump includes hand switch for manual and auto operation and on-off level control.	1/6
21	P- 202	Carbon Adsorber Feed Pump		Goulds Model LF3196, Pump Size STX 1 x 1 1/2- 8, Casing - Ductile Iron, Impeller - 316 Stainless Steel	
22	PDISH- 203	Cartridge Filter High Differential Pressure Switch	1	Dwyer Series 43000 Capsu-Photohelic Pressure Switch/Gages, Brass case for water usage, 1/8" NPT pressure connections, range 0-20 PSID.	
23	PDISH- 212	Carbon Adsorbers High Differential Pressure Switch	1	Dwyer Series 43000 Capsu-Photohelic Pressure Switch/Gages, Brass case for water usage, 1/8" NPT pressure connections, range 0-20 PSID.	
24	PI- 210	Adsorber Pump Pressure Gauge	1	Control System Specialists, Acragage 1500 series process gauge, 4.5 in phenolic case, 1/2" lower mount, glycerin filled case, scale 0-60 psig	
25	PI- 211	Effluent Pressure Gauge		Control System Specialists, Acragage 1500 series process gauge, 4.5 in. phenolic case, 1/2" lower mount, glycerin filled case, scale 0-30 psig	
26	204, PISH- 205, 206	Carbon Adsorber High Pressure Switch	3	Dwyer Series 43000 Capsu-Photohelic Pressure Switch/Gages, Brass case for water usage, 1/8" NPT pressure connections, range 0-20 PSID.	
27	TK- 201	Holding Tank	1	Carbon steel tank, 5-foot diameter by 6-foot high, interior lining with Plasite 4110 and exterior painted with epoxy mastic.	

EQUIPMENT LIST - NEC -501 ELLIS STREET SECTION IV - UNNUMBERED TREATMENT PLANT EQUIPMENT

ITEM	EQUIPMENT NO.	EQUIPMENT NAME	QUAN.	DESCRIPTION/TYPE	MOTOR HP
1	NA	Carbon Adsorber Inlet Pressure Regulator	1	Fisher 95 Series Pressure Regulator, type 95 L, 10 psig outlet pressure, regulator body size, 1 inch, neoprene diaphragm, cast iron body and spring case, 1 inch FNPT.	
2	NA	Carbon Adsorber Inlet Pressure Relief Valve	3 4	Fisher 98 Series Relief Valve, Type 98 H with stainless steel diaphragm and cast iron body and spring case. Relief pressure setting 12 psig, 1 inch FNPT	
3	NA	Carbon Adsorber Outlet Pressure Regulator	·	Fisher 95 Series Pressure Regulator, type 95 L, 10 psig outlet pressure, regulator body size, 1 inch, neoprene diaphragm, cast iron body and spring case, 1 inch FNPT.	
4	NA	Control Panel	l	Hoffman Catalog No. A-36R2412 HCR Panel Enclosure. NEMA Type 3R. 14 gauge G-90 grade galvanized steel.	
5	NA	Electrical Panel	1	Westinghouse Catalog No. WMB101224S Meter Breaker Panel, in NEMA 3R enclosure, 120/240 VAC, single phase, 3 wire with 100 A main breaker, 4-2 pole 20 amp & 4-1-pole 20 amp breakers with neutral and ground bus.	
6	NA	Hose			
7	NA	Motor Starter	1	Motor circuit protector type with instantaneous-only trip circuit breaker and separate overload device, one thermal overload relay per phase, 2 N.O. and 2 N. C. spare contacts in NEMA 3R enclosure for carbon adsorber feed pump (220V, 1 phase, 1.5 HP)	

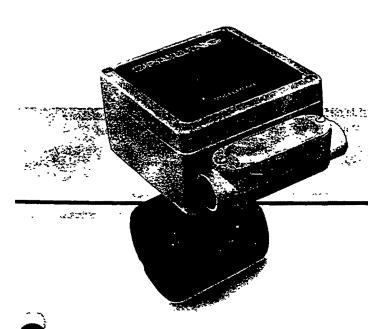
EQUIPMENT LIST - NEC -501 ELLIS STREET SECTION V - EXTRACTION WELL AND TREATMENT PLANT

ITEM	EQUIPMENT NO.	EQUIPMENT NAME	QUAN.	DESCRIPTION/TYPE	MOTOR HP
1	XA-300	Remote Alarm Dialing Monitor		Verbatim by RACO Series VSS, unit shall monitor the presence of AC power and 16 contact closure inputs and be field upgradeable to 32 inputs. Dialer shall be able to dial up to 16 phone numbers and have voice message recording and playback capability.	
2	NA	HDPE Dual Containment Piping	I .	1-inch carrier pipe within a 3-inch containment pipe. The carrier and containment pipe s be PE3408 HDPE as defined in item 3. Service ratings are a 160 psi, for the carrier pipe, and 15 psi, for the containment pipe.	
3	NA	HDPE Piping (1)	Lot	Plexco by Chevron, 1-inch to 1 1/2-inch diameter HDPE. HDPE shall be made from a high density, extra high molecular weight material with molecular weight distribution designated as a PE 3408 with an ASTM D 3350-83 cell classification number of 345434C.	
4	NA .	PVC Piping (1)	Lot	3/8-inch to 1 1/2-inch diameter schedule 80 PVC piping, Pipe material used in the manufacturing of pipe will meet ASTM-D-1784-65T for a PVC Type 1 material. Pipe shall conform to ASTM-D-1785. PVC pipe shall have the same O.D. and I.D. as the corresponding schedule of iron or galvanized pipe.	_

CATALOG CUTS

SECTION I

EXTRACTION WELLS - NEC1AE, NEC22AE AND NEC27EA





FOR IRRIGATION AND OTHER WATER MONITORING APPLICATIONS



- 1 Flow Indicator FI-101-1, 102-1, 103-1
 - Flow Totalizer FQI-101, 102, 103

5

Extraction Well Flow Meter and Transmitter FT-101, 102, 103

C-I-2

Sparling also manufactures MICROPROCESSOR-BASED MAGNETIC FLOWMETERS—ULTRASONIC FLOWMETERS

Open Channel/Level and Transit-Time models— and PROPELLER FLOWMETERS in a wide range of sizes.

Call us with your application details: 1-800-800-FLOW

SPARLING... Supplying Reliable Flowmeters to The Following Industries

Municipal

Raw Sewage Primary Sludge Activated Sludge Digested Sludge Septic Sludge Aerobic Sludge Polymer Feed Waste Water

Power

Cooling Water Recirculation Water Lime Slurnes Fly Ash Slurnes Coal Slurnes Coal/Oil Mixtures

Pulp and Paper

Paper Stock
Pulp Stock
Cooling Water
Refiner Flows
Wash Water
Waste Water

Mining/Mineral Processing

Tailings Ore Slumes Washer Flows Waste Water

Food

Process Water Cooling Water Waste Water

Chemical and Petrochemical

Waste Water Cooling Water Slurnes Process Water

Other Appications

Potable Water Well & Irngation Water Inks and Dyes

For aggressive applications ask about our Tigermag series.



Worldwide Representation Guarantees Local Customer Service

Domestic Representatives

Albany, NY
Albuquerque, NM
Annapolis, MD
Atlanta, GA
Baitimore, MD
Baton Rouge, LA
Billings, MT
Boston, MA
Buffalo, NY
Charlotte, NC
Chrcago, IL
Cincinnati, OH

Cleveland, OH
Dallas, TX
Davenport, IA
Denver, CO
Detroit, Mi
Great Falls, MT
Houston, TX
Indianapolis, IN
Kansas City, MO
Knoxville, TN
Lafayette, IN
Little Rock, AR

Los Angeles, CA Lynchburg, VA Memphis, TN Milwaukee, WI Minneapolis, MN Nashville, TN New Orleans, LA New York, NY Okdahoma Crty, OK Philadelphia, PA

Phoenix, AZ

Honolulu, HI

Prttsburgh, PA Richmond, VA Rochester, NY Saft Lake City, UT San Antonio, TX San Francisco, CA Seattle, WA St. Louis, MO Syracuse, NY Tampa, FL

Puerto Rico

International Agents

Argentina Australia Austria Belgium Brunei Canada Chile Ecuador France Germany Israel
Italy
Japan
Luxembourg
Malaysia
Mexico
Netherlands
New Zealand

Norway

Portugal

Sweden
Switzerland
Taiwan
Thailand
and Turkey

Singapore

South Korea

Spain

United Arab Emirates United Kingdom Venezuela



SPARLING

Made in U.S.A.

4097 North Temple City Blvd., El Monte, CA 91731 Call Toll Free 800/800-FLOW FAX: 818/452-0723

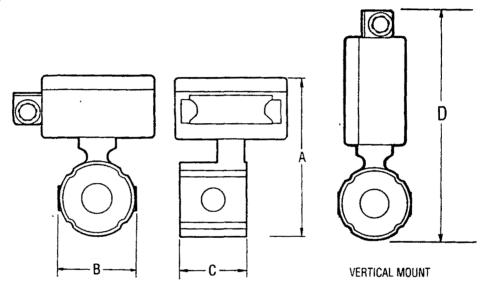
Waterhawk photo courtesy of Bruce Coleman, LTD

C-I-3



WATERHAWK Flow and Dimensional Data Nominal Meter Size Gallons Per Minute* -Dimensions In Inches ±2% above 1 fps Min full scale (MM) (INCHES) Max. full scale В D VERTICAL 3FPS 33FPS 1FPS MOUNTING 16 48 53 769 25 10 292 406 12.09 50 20 7 21 231 9 25 4 25 4.06 1365 30 80 20 60 660 10 58 540 6.06 15.28 100 40 35 105 1155 12 22 660 606 16 62 150 60 88 264 2910 1460 900 800 19.12 200 80 147 441 4850 1665 1070 800 21 37

Gallons per minute calculated at actual meter ID



Standard Specifications

Full Scale Range

From 0-3 to 0-33fps (0-10 mps)

Accuracy (Freq Output)

±2 0% of rate 1-33 fps (3-10 mps)

 ± 0.02 fps below 1.0 fps regardless of full scale

Repeatability

Outputs

Isolated analog 4-20 mAdc into 800 ohms

Power Requirements

(Scaled pulse or frequency optional).

100, 117, 230 Vac ±10% 50/60 Hz. (24 Vdc optional 4 wire)

Power Consumption

.Less than 25 VA

Transmitter

Cast aluminum with corrosion resistant epoxy

coating

Integral or remote mounted

NEMA 4X (Remote mount req'd >158°F .

(70°C)

Flow Sensor Housing

Cast ductile iron with corrosion

resistant epoxy epoxy coating

End Connections

Flangeless Requires installation between ANSI,

AWWA, DIN, BS, AS or JIS flanges

Grounding rings may be

required

Max Process Temp

Environmental Rating

NEMA 4X hose-down proof

Electrical Rating

General Purpose.

180°F (82°C)

Positive Zero Return

Drives output to zero at no-flow conditions

Pre-amp Impedance

1012 ohms minimum

Amblent Temperature

-20° to 120°F (-30° to 49°C)

Damping

Adjustable 2-12 seconds

Low Flow Cut-off

.Fixed, 2% FS

Electrodes

316 stainless steel standard (others optional)

Liner

Polyurethane

Conductivity

Minimum 20 micromho/cm

Options

- · Flow rate indicator/totalizer
- · Electrodes (Titanium, Tantalum, Zirconium, Hastelloy C)
- Remote mounted transmitter >158°F (70°C)
- · Vertical transmitter mounting
- Mounting hardware and gaskets
- 24 Vdc power supply 4 wire
- ± 1 0% rate calibration
- Scaled pulse/frequency output
- Submergence proof sensor construction

For further information, request product data sheet PDS-621

C-I-4



Sparling Instruments Co., with seven decades of flowmeter experience, has produced a low cost, multi-purpose meter that combines simplicity and reliability to accommodate a wide range of conductive applications.

The Sparling Model 621 Waterhawk electromagnetic flowmeter is an obstructionless, low-maintenance alternative to mechanical flow devices. This water-style meter offers the user economical flow monitoring with all-electronic performance made possible by Sparling's bi-polar pulsed dc technology.

You can consider the Waterhawk for liquids with conductivities as low as 20 micromhos/cm

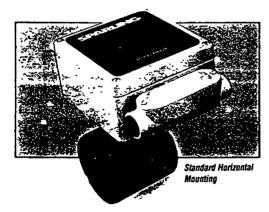
The Waterhawk's standard configuration is a blind transmitter, but it is also available with LCD digital flow rate indicator and eight-digit flow totalizer.

The Waterhawk's performance is independent of liquid density, temperature, viscosity or pressure. The simple design allows you to install the meter quickly with unskilled personnel It's virtually maintenance-free. Set it and forget it.

- · No Nonsense Reliability
- Proven Technology
- Unequaled Customer Support

he Waterhawk is a flangeless meter for pipe sizes 1° to 8° in diameter and can be installed between AWWA, ANSI, DIN, BS, AS, or JIS flanges.

The rugged flow sensor is constructed of cast ductile iron protected by a tough polyurethane liner for excellent corrosion and abrasion resistance



Stainless steel electrodes are standard, but several other high-tech choices are available. The Waterhawk resists scale buildup and eliminates the need for expensive electrode cleaners. A high-input impedance circuit assures optimum signal to noise ratios.

Built-in grounding electrodes make it unnecessary to install costly grounding rings or straps in most applications utilizing metallic piping



You can equip the Waterhawk in four different configurations:

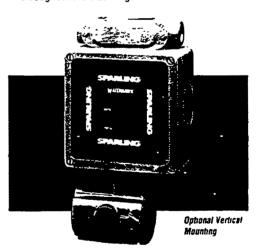
- As a blind transmitter with analog and/or optional pulse or frequency output.
- 2. With an optional LCD flow rate indicator.
- 3 With an optional 8-digit totalizer
- 4 With both flow rate indicator and totalizer.

The Waterhawk Includes These Value-Added Features:

- . Isolated Apalog Output
- Built-in Grounding Electrodes
- Positive Zero Return
- · Adjustable Damping
- . Low Flow Cut-Off

The Waterhawk is protected by a Two-Year Warranty.

The electronics transmitter, housed in a NEMA 4X cast aluminum enclosure, is mounted on the flow sensor horizontally as standard. It can be remote mounted when application conditions dictate. Vertical transmitter mounting is available as an option The electronics are completely interchangeable throughout the size range.



An isolated 4-20 mA output proportional to flow can be interfaced with a chart recorder or remote mounted indicator. The optional 24 Vdc pulse or frequency output is easily connected to an external device

Applications include well monitoring, waste water, cooling water, potable water and many other less corrosive liquids.

(-I-5

AC VOLTS PH-101

BG Series Edgewise Single BarGraphs ™

The Weschler BG Series Edgewise Single BarGraphs consist of several 6" size and DIN-size BarGraphs for horizontal and vertical orientation. Specific models are available for direct retrofit applications; contact factory.

Weschler's 101 segment LED BarGraph offers the best of both analog and digital solid state instrumentation. The 101 segment bar display gives you 1% resolution with analog trend indication. The bar display provides the operator with a quick view on the status of the measured signal or control setpoints. The 4-1/2 or 3-1/2 digit display provides the highest accuracy readings of the signal variable. Programming setpoints is accurately and easily accomplished. Weschler's BarGraph family of instruments fits a wide range of input signals and has retrofit sizes where most panel and switchboard meters are being used today. Our instruments satisfy the high quality standards set forth by the utility, OEM and process control industries.

FEATURES

BG-252

High resolution 101 segment LED bar array

Programmable functions

Zero point location
Setpoint location
Hysteresis (setpoint, trend)
Span and zero
Digital display for engineering units
Enable/disable front buttons
I.D. selection for communication

Form-C Relay Outputs

Normally Open

SA, resistive @ 250VAC

SA. resistive @ 28VDC

Normally Closed

3A, resistive @ 250VAC

2A, resistive @ 28VDC

Peak and Valley hold.

Trend indication for signal direction.

Communication

RS232 / 422 / 485 SCADA DCS

Analog retransmit

4-20, 10-50, 0-1mDAC 1-5, 0-1, 0-5 VDC

Retrofft sizes for:

GE/Yokogawa 180. Crompton 128, Dixson SA/BB 101 (all models), Dixson BJ101, Sigma/International Instruments 1151, Hays Republic 3600/V5A. Foxboro 65PP, Weston 1316.

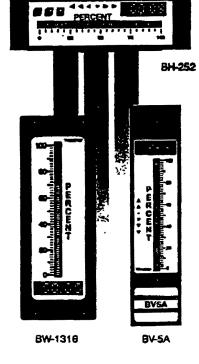
3-1/2 or 4-1/2 digit display with resolution up to 0.01%.

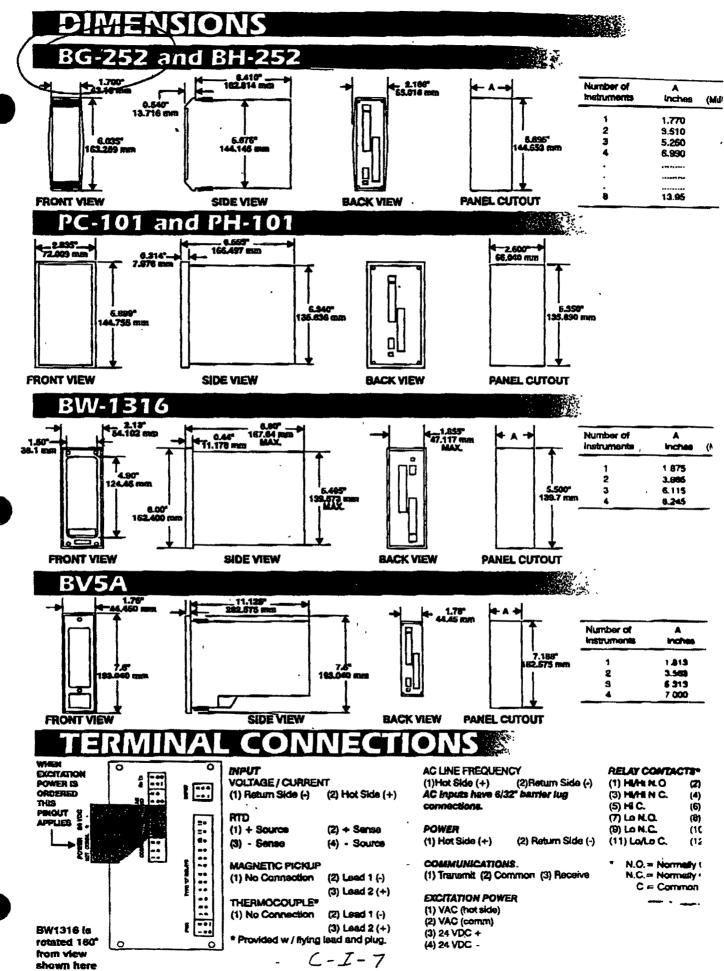
Most versatile selection of inputs in the industry

Frequency

Process Control

2 Flow Indicator FI-101-2, 102-2, 103-2





Options and features vary between models, contact factory for specifics.

May 1991

Data Sheet 14 15

Description

The DRM Data Recorder Module provides a simple and accurate method to collect, store and evaluate process (temperature, pressure, level and flow) data for trending, troubleshooting, alarming and calibration.

The DRM is the ideal replacement for troublesome strip and circular chart recorders. It collects current (e.g., 4-20mA) and voltage (e.g., 1-5V) process signals from signal transmitters, conditioners and other analog devices, and safely stores the collected values in digital form. The DRM then transfers the data directly into a wide range of popular personal computers via an RS-232C format. Once downloaded, the menu-driven DRM Support Software is used to display the data in report or graph form. Custom reports and graphs can also be created by transferring the data into compatible data base programs.

For collecting stored data from the DRM without removing the unit from its collection location, Moore Industries offers the DTM Data Transfer Module. The rugged, hand-held DTM collects information from up to 15 DRMs, stores the data, then downloads it into a PC (see back page for details)

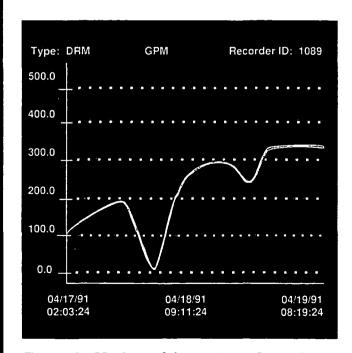
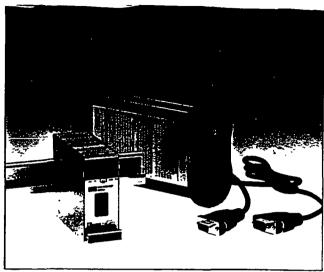


Figure 1. The DRM Support Software is Used to Plot and Display Collected Process Values in Engineering Units



The DRM Data Recorder Module collects, stores and directly transfers process data into a PC for playback and analysis

Features

- Digital data collection and transfer. Performs safe and accurate data collection while reducing costs by eliminating the need to perform timeconsuming and often inaccurate manual paper-tocomputer data transfer
- Compatible with popular computers. Using the DRM Support Software, the DRM downloads directly into a wide range of popular PCs for instant data readout and analysis. Custom reports and graphs can be created using popular data base programs
- Battery- or externally-powered. Internal batteries provide unattended operation for a minimum of three years making the DRM ideal for use in remote and hard-to-get-at locations. The recorder will also operate indefinitely from an external Vdc power supply.
- Time stamps data. When collected, data is automatically time stamped to make precise tracing and identification of individual process events fast and simple.
- Loop integrity protection. The 4-20mA input DRM incorporates a removable terminal block with a diode assembly to allow removal of the DRM without interrupting the current loop

edid selection of	िर्वाभिताल मुंबस्तालिकावित	Roman Politikary (har e gaj a sadah radakaran s
prompings thin Maggar	TIME OF A Superference of the	egalgist pilities, Courte
Capacity Car to see	Manyo	21/201920
२ ९ मध्येक्षितः १ व्यवस्थानः		- वहारितिकारी है कि के लिए हैं।
rigie gen gefreinfaber bi Biate	white thinks to the man it is	the state of the s
restricted (State - per 1997)	CONVERTION Provides	ondefine juri (Lie Konterise) valu Kurulanski kurulanski
ប់ទីកម្មវិធីស្រីស្រីស្រី Yatib ស្រាក្នុងការការបាន ប៉ុន្តិការ ការការការការបាន បានការការការការការការការការការការការការការក	MV energy	with the property of the control of
in the <u>Professional Comments of the Comments </u>	9900 : See - 1.202 - 1.000	reinkritägen kritigen in eine
CONTRACTOR OF SECTION	item satem sate and an interest	
Distance of the property	COR SUBJECT CONTRIBUTION OF THE PROPERTY OF TH	
Orilino lessement 17 336	5000 rating the formated	Housing HH Hand Held Housing
a values	Service and State (1) called a section with	fion-corrossive and impac
	PROPERTY OF THE PROPERTY OF TH	resistant with lanyard tandle for carrying the
Amblent Operating Hangly >>6	Professional Profession Professional Profess	Figit or attaching it to a
imperature o reo°C (75%=1	and an arrangement of the company	bipe or railing to
Storage Range: #0 Sto	Signer And Signer Cable	
470°C (-40°F to +158°F)	(plug connector) allows	Accessories NOTE: Order as
	connection to a DRM and	separate items using the
weight ຊະໃb. 10 oz. (732 grams) 🗎	a 6-Inch cable (receptacle	part number (P/N) listed: P/N 800-836-52 Replace-
	connector) allow connec-	ment batteries
imensions 2.13" (54.1mm) x 7.0" (177.8mm) x 4.09	tion to the DRM RS-232C	P/N 203-231-11 Carrying
(177.8mm) x 4.09	Sign of the menace capie of	case

Data Transfer Module (DTM)

The rugged, hand-held DTM Data Transfer Module (DTM) collects data from up to 15 remotely-located DRM Data Recorder Modules and transfers the data directly into a PC. The DTM allows data to be collected from the DRM without removing the unit from its sampling location.

Two integral cables are provided with the DRM One is used to connect the DTM to the DRM during data transfer; the other connects the DTM to a cable that connects to the RS-232 port on the host computer for downloading.

Operation—Information is downloaded from the DRM to the DTM by connecting the DTM to the DRM and pushing a button located on top of the DTM. Indication of remaining DTM memory capacity can be determined by pushing the button on top of the unit and viewing the LED also located on the top of the unit's housing. The DTM transfers col-

lected data to the computer using the support software

Memory—Any combination of process data records totaling up to 120 Kbytes can be stored in a single DTM. This is equivalent to the contents of 15 separate DRM Data Recorder Modules with up to 6,512 values each.

Downloading—When downloading the process data, the host computer can be instructed through the support software to generate separate data files for each individual data set. These data files can then be analyzed at a later time along with any other data files that might have been directly downloaded from any other individual recorders. After downloading, the DTM memory may be cleared using the support software so that it may collect 15 sets of fresh process data.

It is also possible to perform the data transfer from the DRM to the host computer using a modem on each end of the communication line



United States Telephone. (818) 894-7111 • FAX (818) 891-2816 Australia Telephone. (02) 525-9177 • FAX (02) 525-7296

Belgium Telephone 03/235 35 44 • FAX 03/271 00 17 Netherlands Telephone. 03440-17971 • FAX: 03440-15920

Singapore Telephone: (65) 7634511 • FAX: (65) 7636176 United Kingdom Telephone: 0293 514488 • FAX 0293 536852

Data Recorder Module and Data Transfer Module

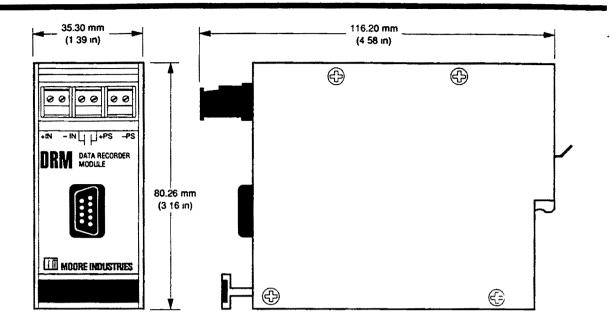


Figure 3. DRM Installation Dimensions

Ordering Information

To construct the correct model number, use the bold face data from the DRM and/or DTM Specification tables listed under "Ordering Specifications" For assistance during this procedure, refer to the model number example presented in the Specification table

Installation

The DRM's DIN-style housing is designed for high density mounting on a G-type DIN rail Installation dimensions for the DRM are presented in Figure 3 above. Moore Industries also offers a variety of NEMA 4X enclosures for installing the DRM in locations requiring protection from dust, moisture and corrosion.

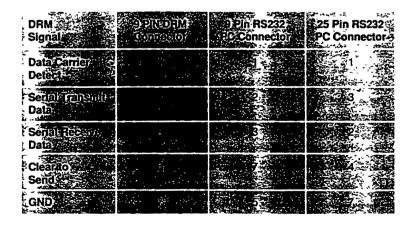


Figure 4. DRM Connector Information

DRM & DTM

Data Recorder Module and Data Transfer Module

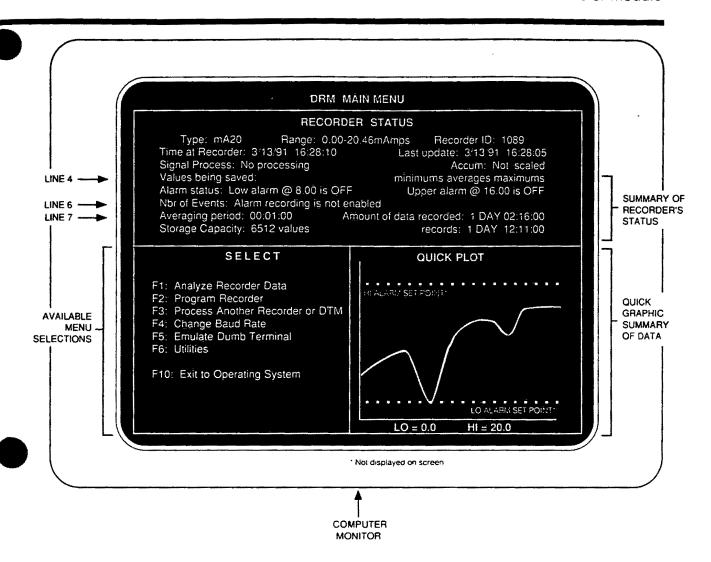


Figure 2. Graphical Presentation of DRM Support Software Screen



Operation

The DRM Data Recorder Module converts a current or voltage loop input into a series of values which are stored in a secure solid state memory. Sampling the input once per second, the DRM can store up to 6,512 minimum, average or maximum sample values (i.e., MIN, AVG or MAX, or all at the same time, or MAX + MIN, MIN + AVG, or MAX + AVG) at user-defined intervals. The interval can be selected within a range from once per second to once every eight hours. If memory capacity is set for 6,512 average values and the recording period is set for once per minute, the DRM can record up to 108.5 hours.

The DRM can then be removed from its collection location and plugged into the serial communications port of a host computer via an RS-232 interface. The data may also be collected from the DRM using the DTM Data Transfer Module (see back page for details)

*The DRM can perform square root extraction and has an accumulator which is incremented every second by the current reading. It also has an alarm logging function that can be turned on or off where the DRM does not record until the input exceeds an alarm set point.

Support Software

Moore Industries' user-friendly DRM Support Software retrieves data directly from the DRM or from the DTM. Using the transferred information, the software performs the computations necessary to store and display graphs and print out the time stamped data records.

The software is also used to initially program the DRM. By processing user-entered menu choices, the software sends the proper commands to the recorder so that a number of parameters may be programmed including: recorder ID, time/date settings, recording rate, alarm levels, and statistics to record. IBM-PC compatible, the support software is supplied on either a 5-1/4 inch double-sided, double density floppy disk or a 3-1/2 inch floppy disk in MS-DOS format. To use the support software, the following equipment is required:

- IBM, AT & T, Compaq or other true compatible (consult the factory for a complete list of compatible computers);
- At least 512K of memory:
- One double-sided, double density disk drive (Two preferred);
- A CGA, EGA, or Monochrome graphics card.
- A compatible monitor (CGA, EGA, or Monochrome),

- An optional IBM compatible graphics printer.
- A serial communications port configured as COM 1 or COM 2, and
- An MS-DOS operating system (version 2 11 or later)

Software Main Menu

The DRM Support Software features an easy-to-read main menu that displays a summary of the DRM's status, main menu selections and quick plot graph (see Figure 2.)

Recorder Status—The top half of the screen is devoted to a summary of the recorder's status. The unit's clock setting, alarm status, and storage capacity are all displayed along with other pertinent information such as: Line 4 indicates whether the values being saved are minimums, averages or maximums. Line 6 indicates the length of the user-specified recording period in HH/MM/SS format; and Line 7 indicates how much data (in units of time) are stored in the recorder's memory. Note that when the memory is full the Line 7 value remains constant since at the end of each recording period the oldest data is discarded to permit storage of the most recently recorded value.

Main Menu Selections—Main menu selections (F1–F6) are presented in the lower left portion of the screen. Of these, the two functions that will likely be performed the most are: Analyze Recorder Data (F1) which is used mostly for displaying, graphing and printing recorder data, and Program the Recorder (F2) which is used to program the parameters in the Recorder Status (upper) portion of the menu (i.e. the clock, alarms, recording period, storage capacity etc.). Other main menu selection functions include Process Another Recorder or DTM (F3); Change Baud Rate (F4); and Emulating a Dumb Terminal (F5). A Utilities function (F6) is also included and is used for system configuration or to scale the recorder to the appropriate engineering units

Quick Plot—This portion, which is located on the lower right portion of the screen, is used to provide an unscaled graphic summary of the data contained in the recorder. This can be done without having to perform a detailed analysis of the data (which can be performed using the "Analyze Recorder Data" selection function — F1). The Quick Plot function, therefore, can be used to tell if the attached recorder contains data that is of further interest.

Trademarks: IBM and IBM-PC are trademarks of International Business Machines Corporation MS-DOS is a trademark of Microsoft Inc. AT & T is a trademark of a nic Telephone and Telegraph Inc. Compaq is a trademark of Compaq Computer Corporation.



DRM & DTM Data Recorder Module and Data Transfer Module

haracte	ristics	50:53	g-AZHUNGGA ARARAMAN Makadaman makada		
riormance	Storeable Values		Programmable Cocks		connected) someone
	celecteds adverning about	S. PARTILL STREET	Consideration of the state of t	**************************************	Conminition of the
	Communication of the second		· See Links com Parish Parish Parish		
	Memory Capacity	14. 14. 11	Description believes	DOM:	22000
	ASIOTES FOUNDERS TO SERVICE		Telegiste general felle general genera		TOTAL DESIGNATION OF THE PROPERTY OF THE PROPE
	6512 yalues (10)		die een Ser in it fan it in in it in in it in		TOPEVIE BY
	until downloaded				replaceable lithum
	Sample Rate: Samples	Alam	Type: Low power	**	Datteries (SAFT LITHIUM CASE) LS6-BA or equivalent);
ارا - المجارة المراجعة معطوم المراجعة	Input once per second Recording Interval:		transistor (FET) switch		Operating Life: At 25°C
	Recording interval can		Max. Voltage: 30Vdc		(77°F), when DRM is used exclusively in data
	range from once per second to once every		On/Off Impedance: 15		gathering operating mode,
	eight hours; recording		Rohms/1 Megohm mominal	La Paris	the internal batteries
W. C. S. C.	period selected must be		Threshold: Trip points for: HI and/or LO alarms are		operate the unit a minimum of three years;
". ". ". ". ". ". ". ". ". ". ". ". ". "	evenly divisible into 24 hours		user-selectable via the		Battery Shelf Life: 5 years;
T. 7. 2.	Sample Accuracy:		support software within		Storage Capacitor: Allows
April 1997	Current Input Models: ±.004% of span/°C for 0-		entire input range with a resolution of 8 bits (1 part	- A.	Battery replacement within 60 seconds without loss of
The state of the s	50°C ambient temperature	A STATE OF THE STA	in 256)	Section 1	unit function and
Total Section 1985 And Control of the Control of th	changes	Weight	11 oz. (312 grams) without	-4.	performance Backup: When sufficient
	Voltage Input Models: 0-1: 0-5V ± 008% of		cable: 14 oz. 7397 brams) = 1		external power is applied
Service .	span/°C and 0-10: ±.02%	Maria Company	with cable	Carle Balling Control	(i.e., 9V), the internal
. (4.	of span/°C for 0-50°C		The second of th		"batteries are in standby" "" mode. On loss of external
1-24 1-24	ambient temperature changes	SECTORING	Specifications		power, unit runs on
and grade	Resolution: 0.1% (10	"Sections	DRM Data Recorder		internal battenes
-	isolation: Output is opto-		Module -	The Contract of the Contract o	DIN Aluminum DIN-style
and a first	isolated from the case,		一大学 化 图 图 图 图 图 图 图 图 图 图 图 图 图 图 图 图 图 图		rail-mount housing
	power, and the input:		0-20MA 0-20mA (will withstand up to 35mA	Accessories	NOTE: Order as
	RFI/EMI Protection; Less.		STORE WILL A CONTROL OF		separate items using the
	than ±0.1% of sounds	200	Appendix miles conformed a		part number (P/N) listed: P/N 800-837-52 Replace: 1
-	Change in enty data: alive /		2012		trent batte (as 12
	avidada financia		Service Control		P/N 143-75001-013
	2000 500 NEW WORLDAN		A CONTRACTOR OF THE PARTY OF TH		TO SOURCE
	Sandard PM		I All		PAN 43-75001-02
Inblem			Lande Eller Spirit Spir		
mperature	In (0.C)		Aller September 1997 and	100 to 10	P.N. 301-838-26
			And Charles	100	A STATE OF THE STA
ustments	7-0		· · · · · · · · · · · · · · · · · · ·		7(180E3925
	Tal Vistania	shirtle	SAPER COLUMN		The second of the second of
	Company of the second second		This of the West of the confidence		are at the confe
	r ninal via		This probably Hotel Statement . This probably has stories in Hopel .		
	Dollanborne (s)	A STATE OF THE STA	The second second		1. 建聚丁基聚二十亿
	lic roeweer and a second		All field stelleters by the en		Today The same
1	ze o adjustments		7		经第二十分 知一一十時本



Kotron Sentinel
R.F. Level Transmitter
and Point Switches

The Sentinel is a powerful level transmitter or multi-point level switch in a cost effective package. The leading edge, microprocessor-based circuitry has nonvolable memory, so it needs no battery backup to protect from data loss. Powerful diagnostics check all major aspects of the system, while MagneCal offers the user the greatest improvement in R.F. Capacitance — little or no level change needed to calibrate.

Features

+ MagneCal

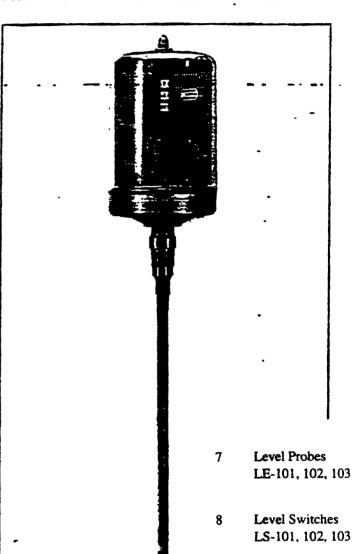
- 3 button/4-digit LED data entry of all parameters.
- One small level change needed for initial calibration in most cases.
- Up to 4 relay control points, Series 802 transmitter, and 8 relay control points, Series 822/832/842 point switch calibrated with no level change.
- Units can be shipped pre-calibrated so no level change is needed.
- Some units can be precatibrated in one medium (eg. water) then applied to any other media.

+ Sentinel diagnostics

- Powerful self-diagnostics check the system every 10 seconds minimizing the need for routine maintenance checks.
- Diagnostics display up to 16 error messages showing status of microprocessor, stored data, cable, preamplifier and probe for simplified troubleshooting.
- Diagnostics check the integrity of the probe.
- One relay can be dedicated as a diagnostic alarm.
- Output signal can default to 4 mA, 20 mA, or last value, on Series 802 transmitter.

- Isolated 4-20 mA output includes 0-90 second damping to stabilize signal in turbulent applications.
- Optional intrinsically safe probe circuitry (with onboard barriers) allows safe use even with bare probes in hazardous media.
- i.S. remote mount models, up to 800' (240 m) of cable.
- Integral or standard remote mount up to 2500' (760 m) for application flexibility.
- 2 to 4 DPDT relays yield wide application flexibility for most alarm and control schemes.
- Relays 2 and 3, Series 832/842 point switch models only, may be used for lead/lag pump sequencing.
- Probe circuitry is designed and tested to meet IEC electrostatic discharge specification 801-2.
- 0 to 90 second time delay eliminates relay chatter due to turbulence.
- Usable with all Kotron probes for excellent application flexibility.

Kotron Sentinel R.F. Level Transmitter



Applications

- Hydrocarbons & solvents
- Corrosives acids & caustics
- . Powders & granulars
- High temperature/ pressure liquids
- Elevan at a requirement tradement of General Sectric.

The level and flow specialist

Principle of operation

The amount of capacitance developed in any vessel, is determined by the size (surface area) of the probe, the distance from the probe to its ground reference, and the dielectric constant of the medium it is measuring.

Assuming that the probe's mounting position and the dielectric of the medium

are fixed, the amount of capacitance, developed in any vessel, becomes dependent upon the probe's diameter and length to determine its surface area. Adjusting the combination of the probe's diameter and length (and its proximity to ground reference), in any given application, can generate

the necessary capacitance required by the electronic circuitry.

As the media rises and falls in the tank, the amount of capacitance, developed between the probe and the ground reference, also rises and falls. The Pulsatel circuit, mounted on the probe,

changes the capacitance signal to a variable frequency. Series 822/832/842 point level switch or a pulse wave form Series 802 level transmitter, proportional to the change in level. The Series 802 amplifier then converts this digital pulse signal into an isolated 4-20 mA analog output signal.

Intrinsic safety

Models 8X2-1XX4-X0X and 8X2-1XX6-G0X are FM and CSA agency approved for use as an intrinsically safe circuit per the instructions on Drawing 99-5043-001 shown below.

NOTE: CSA is not available for Groups E & F.

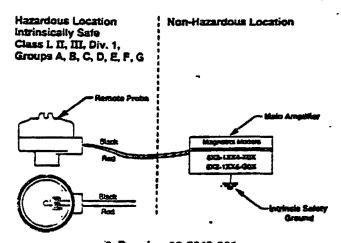
Intrinsically Safe/Sécunté Intrinsèque

WARNING: Substitution of components may impair intrinsic safety.

Models 8X2-1XX6-GOX are FM and CSA agency approved for use as an intrinsically safe circuit per the instructions on Drawing 99-5043-002 shown below.

NOTE: CSA is not available for Groups E & F.

AVERTISSEMENT: La substitution de composants peut compomettre la sécunté intrinsèque.



Drawing 99-5043-001

NOTES:

- 1. The NEC must be followed when installing this equipment.
- 2. For installation guidance, see ANSI/ISA RP 12.6.
- The resistance between the associated apparatus intrinsic safety ground terminal and earth must be less than one ohm.
- Non-hazardous area equipment connected to the associated apparatus should not use or generate more than 250 volts.
- The total cable series inductance and shunt capacitance between the associated apparatus and the remote probe must not exceed the indicated values for applicable groups:

Group	Max. Capacitance	Max. Inductance
AB	0.13 µF	0.47 mH
CE	0.92 uF	1.97 mH
DFG	2.89 uF	3.53 mH

Hazardous Location Intrinsically Safe Class I, II, III, Div. 1, Groups C, D, E, F, G Remote Probe Hazardous Location Explosion proof Class I, Div.1, Groups C. D Oust Ignition Proof Class II, III, Div.1, Groups E, F, G Hazardous Location Explosion proof Class I, Div.1, Groups C. D Oust Ignition Proof Class II, III, Div.1, Groups E, F, G

Drawing 99-5043-002

NOTES:

- 1. The NEC must be followed when installing this equipment.
- 2. For installation guidance, see ANSI/ISA RP 12.6.
- The resistance between the associated apparatus intrinsic salety ground terminal and earth must be less than one ohm.
- Non-hazardous area equipment connected to the associated apparatus should not use or generate more than 250 volts.
- The total cable series inductance and shunt capacitance between the associated apparatus and the remote probe must not exceed the indicated values for applicable groups:

Group	Max. Capacitance	Max. Inductance
AB	0.13 µF	0.47 mH
CE	0.92 µF	1.97 mH
DFG	2.89 uF	3.53 mH

Electrical specifications

Descri	otion	Specification
Supply Voltag	je	120 VAC, 50-60 Hz 240 VAC, 50-60 Hz 24 VDC
	Signal	4-20 mA (Isolated), reversible 1000 ohms-max, loop resistance
Output	Range	5 pF minimum 50,000 pF maximum
Series 802 Transmitter	Damping	0-90 seconds
Models Only	Accuracy	Better than 1.0% of span
	Repeatability	±.1%
	Lineanty	± .5%
	Entry	3-Button Keypad :)
Data	Indication	4-Digit LED 1 Overflow LED (lamp) for +10,000
	AC	10A @ 120/240 VAC resistive
	DC	10A @ 30 VDC resistive
		0.5 A @ 125 VDC resistive
Relays 2 to 4 DPDT	Set Point Range	0-50,000 pF
	Oifferential Range	0.50 pF minimum, 50.000 pF maximum
	Time Delay	0-90 Seconds Level Rising, Falling, Both

Description	Specification			
Power Consumption	15 VA maximum			
Humidity	99% Non-condensing (Electronics)			
Operating Pressure and Temperature	Dependent upon probe selection See bulletin 50-125.			
Electrostatic Discharge Protection	Per IEC specification 801-2.			
Response Time	70 ms to approx. 2 seconds, depending upon probe capacitance and averaging value			
Temperature Coefficient of Set point 40°F to +160°F (-40°C to +70°C)	±.01%/degree F (±.018%/degree C) Input Voltage: <1 pF over full range			
Maximum Remote	Standard: 2500 Feet (760 m)			
Mount Distance	Intrinsically Safe: 800 Feet (240 m)			

Agency approvals

Agency	Model No.	Approval
	8X2-1XX0-XXX (Integral) 8X2-1XX1-XXX (Remote)	Non-Hazardous (Weather proof, NEMA 4X)
	8X2-1XX2-GXX (Integral) 8X2-1XX3-GXX(Remote)	Hazardous (Explosion proof. NEMA 4X) Class I / Div. 1. Groups C & D Class II / Div. 1. Groups E, F & G
,	8X2-1XX4-XXX (Remote)	Intrinsically Safe Remote (Weather proof, NEMA 4X) when installed per Magnetrol drawing 99-5043-001 Class I, II & III, Div. 1, Groups A, B, C, D, E, F & G
FM	8X2-1XX5-GXX (Integral)	Hazardous (Explosion proof, NEMA 4X) with intrinsically Safe Probe Circuitry Class I / Div.1. Groups C & D Class II / Div.1. Groups E, F & G
	eva avve cvv (Ramata)	Intrinsically Safe Remote (Explosion proof, NEMA 4X) when installed per Magnetrol drawing 99-5043-001 Class I, II & III, DN. 1, Groups A, B, C, D. E, F & G
•		Hazardous Remote (Explosion proof, NEMA 4X) with Intrinsically Safe Probe Circuitry when installed per Magnetrol drawing 99-5043-002. Class I / Div. 1, Groups C & D Class II / Div. 1, Groups C F & G

Agency	Model No.	Approval
	8X2-1XX0-XXX (Integral)@ 8X2-1XX1-XXX (Remote)@	Non-Hazardous (Weather proof, TYPE 4X)
	8X2-1XX2-GXX (Integral) 8X2-1XX3-GXX (Remote)	Hazardous (Explosion proof, TYPE 4X) Class I / Div. 1, Groups C & D Class II / Div. 1, Group G
	8X2-1XX4-XXX (Remote)@	Intrinsically Safe Remote (Weather proof, TYPE 4X) when installed per Magnetrol drawing 99-5043-001 Class I, II & III. Div. 1. Groups A. B. C. D & G
CSA	8X2-1XX5-GXX (integral)	Hazardous (Explosion proof, TYPE 4X) with Immunically Sale Probe Circuitry Class I / Div. 1, Groups C & D Class II / Div. 1, Group G
	·	Intrinsically Safe Remote (Explosion proof, TYPE 4X) when installed per Magnetrol drawing 99-5043-001 Class I, II & III, Dlv. 1, Groups A, B, C, D & G
	8X2-1XX6-GXX (Remote)	Hazardous Remote (Explosion proof, TYPE 4X) with Intrinsically Safe Probe Circuitry when installed per Magnetrol drawing 99-5043-002 Class I / Div. 1, Groups C & D Class II / Dv. 1, Group G

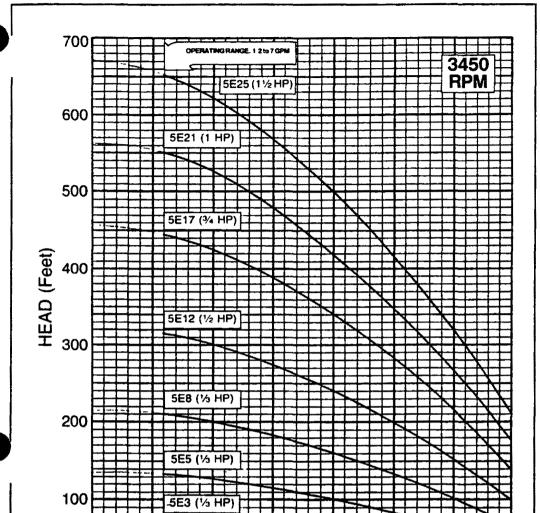
CAUTION: Agency ratings are based partially on the proper probe selection. Refer to the chart at the right for approved combinations.

To retain the TYPE 4X CSA rating, these units must be ordered with a steel cover.

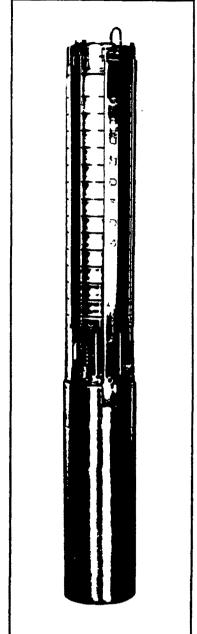
7th Digit in Elect. Model No.	Approved Probes
0,1,4,6 2,3 5	All probes All insulated, rigid probes (except 41-5023) All probes (except 41-5023)



Performance Curves







Materials of Construction

REDI-FLO4 PUMP END	
Check Valve Housing:	304 Stainless Steel
Diffuser Chamber	304 Stainless Steel & Tellons, 5 304 Stainless Steel
Impeller	304 Stainless Steel
SIGION PLACENTING CONTROL STATE OF THE STATE	304 Stainless Steel
Coupling	329/420/431 Stainless Steel
ble Guard	304 Stainless Steel 3
ermediate Bearings	7.304 Stainless Steel 7.7.5.3.3.3.3.3.3.3.3.3.3.3.3.3.3.3.3.3.

NOTE: Specifications are subject to change without notice.

C-I-18

CAPACITY (GPM)

GRUNDFOS ENVIRONM	
Nema Top	304 Stainless Steel
Studs & Fasteners	304 Stainless Steel
Miles and the second	STATE IS IS SIGN 1888 SIGN ASSESSMENT
Sand Slinger	Viton®
Shart Extension	ESSEDIES SAIL
Diaphragm	Viton®
	304 Stathless Steel 22 2 2 2 2 2
Fill Plug Screw	304 Stainless Steel
	Super William Property and Company

GRUNDFOS ENVIRONMENTAL MOTOR LEADS						
Connector Potting	304 Stainless Steel Scotch Cast #4® Epoxy w/Viton® Cap					
Connector Plug A Service Lead Insulation	Vitono Tellono					



Redi-Flo4 **Environmental** Submersible Pumps

Submittal Data

3450 RPM

60 Hertz



	•		-	
	JOB or CUSTOMER:			
-	ENGINEER:			
1				

CONTRACTOR:

SUBMITTED BY:

APPROVED BY:

ORDER NO.:

DATE:	
DATE:	

DATE:

SPECIFICATION REF.: MCNO NODENGE REPRESE

Dimensions

Technical Data

FLOW RANGE: 1.2 to 7 US GPM

MOTORS: Grundfos MS402E Environmental Submersible Motor (Standard)

Maximum Operating Temperature: 104°F (40°C)

Maximum Operating Pressure: 220 PSI Maximum Number of Starts Per Hour: 100

Minimum Recommended Flow Past Motor: 0.25 ft/sec (NOTE: Franklin Pollution Recovery motor is optional.)

DISCHARGE SIZE: 1" NPT

PUMP END CONSTRUCTION MATERIALS: Stainless Steel and Teflon®

INSTALLATION: Unit to be installed vertically for submerged operation.

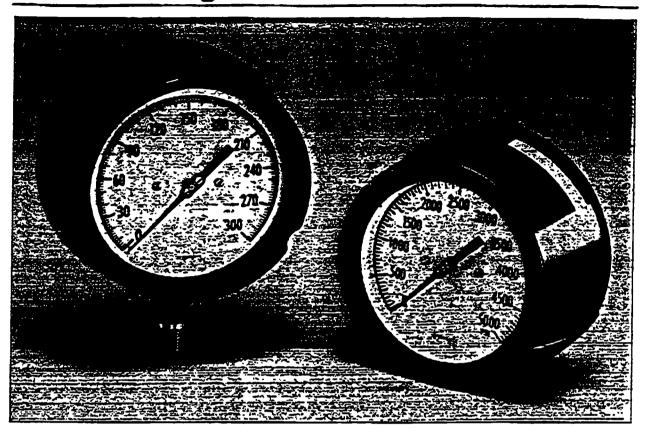
Electrical Data, Dimensions, and Weights ^①

						DIMENSIONS (In Inches)						
PUMP MOTOR			OVERALL LENGTH	MOTOR LENGTH	PUMP END LENGTH	MAX. DIA.	INLET	DISCH. PIPE SIZE (NPT)	NET WEIGHT	SHIP. WEIGHT		
TYPE	HP	SF	PH	VOLTS	Α	B①	С	D	E	F	(LBS.)@	(LBS.)@
\$653 E				2303	新 的宏奏		建	40.80	3200			新教方容
5E5	1/3	1.75	1	230	20 %ie	10	10 ⁵ /18	3 31/32	31/4	1	24	26
FE.				200	1227				6322		21.8	
5E12	1/2	1.60	1	230	26 ¹³ /16	10 ¹³⁄₁s	16	. 3 ³¹ /32	31/4	1	28	29
经自己还是	8.02	11701		建200 0	South S		2000	多级		是是自然	AND 199	第82 多
5E21	1	1.40	1	230	35 ⁷ /16	12	23 1/16	3 31/32	31/4	1	33	35
5E25	1 1/2	1.30	1	230	40 5/16	13 % e	263/4	3 ³¹ /32	31/4	1	35	37

¹ Data for Grundfos MS402E motors. 2 Does not include motor leads.

Process Gauges

Series 1500



The Acragage® 1500 Series process gauges are extremely rugged, accurate, and are designed to meet the most precise requirements of the process industry.

Specifications

DIAL SIZE: 4.5°

"CASE: Phenolic.

WINDOW: Double strength glass standard.

acrylic or shatter proof glass

available.

RING: Polypropylene.

DIAL: White coated aluminum with

black markings.

- POINTER: Micrometer adjustable, black

coated aluminum.

MOVEMENT: 300 Series stainless steel, or brass

completely adjustable.

BOURDON TUBE: Phosphor bronze or SS.

SOCKET: Brass, carbon steel or SS.

CONNECTIONS: 1/2" NPT LM or LBM standard,

1/4" NPT and special

connections available.

ACCURACY: ± 0.5% FS (Grade 2A).

RANGES: See Table VII.

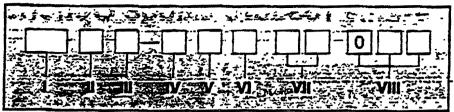
OPTIONS: This gauge is liquid fillable

Refer to last page for Model Selection Chart.

Pressure Gauge PI-101, 102, 103

10

Model Selection Chart



Not all combinations are possible - Please consult factory. Other options are possible.

BB-0-8,000 PSI BC-0-10,000 PSI

	and the same of th
•	•
Table I-Series	Table V-Connection
01-100 Series	· 1-1/8° LM
02-200 Series	2-1/8" CBM
03-300 Series	3-1/4" LM
04-400 Series	5-1/4" LBM
05-500 Series	6-1/2" LM
06-600 Series	7-1/2" LBM
07-700 Series	8-1/4" Autoclave LM
10-1000 Series	9-1/4" Autoclave LBM
15-1500 Series	0-30612 Pl Socket
16-1600 Series	
17-1700 Series ·	
18-1800 Series	Table VI-FIII Fluids
19-1900 Series	1-Dry
20-2000 Series	2-Glycenn
	3-Silicone DC-200
•	4-Mineral Oil
Table II-Dial Size	5-Fluorolube
1-1.5°	
2-2.0	
3-2.5"	Table VII-Ranges &
5-3.5 °	Scales
6-4.0*	AA-30"Hg VAC-0
7-4.5*	AB-30-0-15 PSI
8-6.0°	AC-30-0-30 PSI
	AD-30-0-60 PSI
•	AE-30-0-100 PSI
Table III-Tube/Socket	AF-30-0-150 PSI
1-Phosphor Bronze / Brass	AG-30-0-200 PSI
2-316SS / Carbon Steel	AH-30-0-250 PSI
3-316 SS / 316 SS	. AI-30-0-300 PSI
4-Monel / Monel	AJ-0-15 PSI
5-SS Bellows / SS	AK-0-30 PSI
6-Brass Bellows / Brass	AL-0-60 PSI
	AM-0-100 PSI
	AN-0-160PSI
Table IV-Case	AO-0-200 PSI
A-Plastic, A.B.S., or Equal	AP-0-300 PSI
'B-Steel	AQ-0-400 PSI AR-0-500 PSI
C-Stainless Steel	AR-0-500 PSI

BD-0-15,000 PSI · BE-0-20,000 PSI GA-60" H2Q-0 VAC GB-50" H₂O-0 VAC GC-40" H2O-0 VAC GD-30" H2O-0 VAC GE-20" H₂O-0 VAC GF-10" H2O-0 VAC GG-10-0-10" H₂O GH-15-0-15" H2O GI-20-0-20" H₂O GJ-30-0-30" H2O GK-40-0-40" H₂O GL-50-0-50" H₂O GM-0-10" H₂O GN-0-15" H₂O GO-0-20" H₂O GP-0-30" H₂O GQ-0-40" H2O GR-0-60° H₂O GS-0-80" H₂O GT-0-100° H2O GU-0-160" H2O GV-0-200" H2O GW-0-300" H2O **GX-0-1 PSI GY-0-2 PSI GZ-0-3 PSI** HA-0-5 PSI HB-0-10 PSI HD-50-50" H₂O HF_r0-50" H₂O H0-0-150" H2O HU-0-8 PSI IC-3-15/0-150 PSI ID-0-2.500 PSI IF-3-15/0-300 PSI IG-3-15/0-1,500 PSI IH-3-15/0-5,000 PSI II-3-15/0-500 PSI IK-0-3000 PSI/7600 RAM IM-0-7.500 PSI IQ-3-15/0-1200 PSI IU-3-15/0-2000 PSI IV-3-15/0-3000 PSI IY-0-100 PSI/0-230 ft H2O

AS-0-600 PSI

AT-0-800 PSI

AU-0-1,000 PSI

AV-0-1,500 PSI

AW-0-2,000 PSI

AX-0-3,000 PSI

AY-0-4,000 PSI

AZ-0-5,000 PSI

D-Phenolic

F-Aluminum Flangeless

I-Stainless Front Flange

Flange-Hinged Ring

Flange-Threaded Ring

J-Aluminum Front

R-Aluminum Front

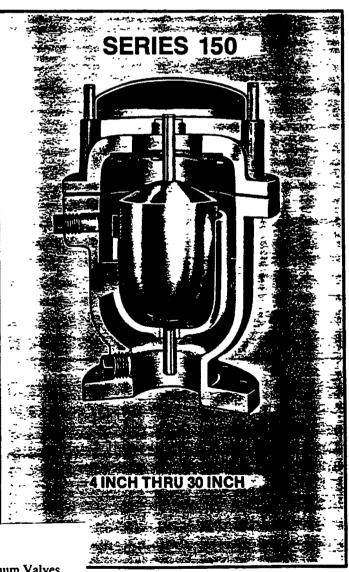
P-SS U-Clamp

BULLETIN
601
REVISED AND REPRINTED
1995

APCO

AIR AND VACUUM VALVES





1 Air and Vacuum Valves

© 1995 Valve & Primer Corporation



C-II-2

>RPORATION G, ILLINOIS 60193-4599 07 • 800/323-6969

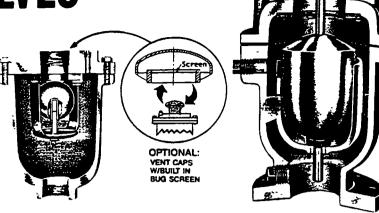
AIR AND VACUUM VALVES

Only APC Gives Guaranteed Protection

- 1 Gives absolute protection to pipe lines
- 2 Eliminates risk of collapsing line due to vacuum
- 3 Exhausts air when line is filled
- 4 Allows air to re-enter immediately when line drains

Plus these exclusive features at no extra cost!

- 5 Stainless steel floats-Guaranteed individually tested
- 6 ASTM quality materials guaranteed throughout
- 7 Every valve hydrostatically, factory tested



SERIES 140

1/2 INCH THRU 3 INCH

OUTLETS ARE NPT THREADED

SERIES 150

4 INCH THRU 30 INCH

OUTLETS ARE PLAIN WITH A STEEL PROTECTOR HOOD. THREADED OR FLANGED OUTLETS AVAILABLE.

Why and Where To Use Air and Vacuum Valves

An Air and Vacuum Valve has a large venting orifice and is used to exhaust large quantities of air from a pipeline when being filled or a "deep well pump column when the pump is started, etc. Once the line is filled the Air and Vacuum Valve closes and remains closed until the liquid is drained and pressure returns to atmospheric. The Air and Vacuum Valve will then immediately open to allow air to reenter the line and prevent a vacuum from developing.

Air and Vacuum Valves do NOT open to exhaust the small pockets of air which collect in the line while it is operating under pressure. We highly recommend for maximum pipeline flow and pump efficiency Automatic Air Release Valves be used in conjunction with Air and Vacuum Valves. The Automatic Air Release Valve will eliminate constricting air pockets from forming at the high points of the pipeline.

The minimal cost for the Automatic Air Release Valve will quickly pay for itself in minimizing head loss thru the pipeline realizing energy savings.

SEE BULLETIN 586-AIR VALVES FOR VERTICAL TURBINE PUMPS

AVAILABLE FOR SERVICE UP TO 1000 P.S.I.

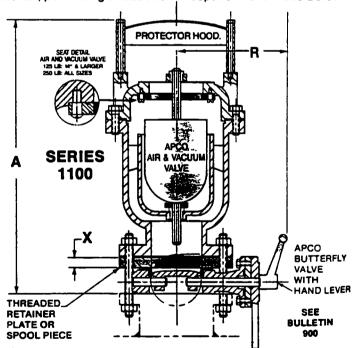
SPECIFY OPERATING PRESSURE IF BELOW 150 P.S.I.

PHYSICAL DIMENSIONS

MOOEL	SIZE	HEIGHT	MAXIMUM DIAMETER	INLET	OUTLET	WEIGHT LBS.
141	7.				7/2 (12)	0.0
142	12	<u> </u>		WINET SINCE	33.11.1	22
144	2		1 /24]	A VEIN	24 (1)	55#
146		rks:	249.	1 - 1/(GE)	क्षेत्रसाधाः	0-
152	1	1114 1114		13 // (GED):	25 a 7.10.	0
153	63	海绵		BELLANGED	BAPPAIN	150%
154	8.	1	75. 3	#8# EANGEDS	850PAIN	482003
155	10~	215/2°	203	2102 ELANGED≨	2002 PEAIN	350
156	124	CANA	1923	HIZGEEANGED!	第1232 图 N元	\$5003
157	14%	30 1/2	1882930	#149EEANGEDS	14SPEAINT	625
158	163	्रहाः		#16#EEANGEDE		
159	18".	QV2		18 ELANGED		¥\$100 a
160	20*	43	美女	20 ELANGED	20"PEAIN	1650
162	24"-	48 68 488	44848	24 ELANGED	2247 PEAINA	¥2600 -

Replace Shut-Off Valves with APCO Butterfly Valves Costs to excavate pipeline trenches can be greatly reduced by using APCO Butterfly Valves for isolation instead of gate valves.

APCO Butterfly Valves are economical, reliable and much shorter, permitting a reduction in depth of trench. See Below.



VALVE	MODEL	MODEL				NO. REQUIRED & SIZE	
SIZE	NO.	COMBINATION	_ A	R A STUDS	NUTS		
4"	-1104	10 TO	12149	48%	فاريق	(8):5/82XXXXX/2.EX	期的 \$8-11
6"	1106	沙斯153度906%	+25%F	10%	dill'	(8) 3/4-10x8 LG #	(16) 3/4-10
8"	1105	908.00 908.00	329 a	\$1478	100	(8)'3/4=1058,EG.	(T16)63/4:10
10"	11109	AND 1550K 910 W	232×	-14%	m2.	(12) 7/8-9x10 LG.	(24) 7/8-9 -
*12"	1112	MEN 560 912 M	439%·	4753	250	(12):778-97851/2 LG	(24)10/8-9-
*14"	11149	间的15万里914 为	440 7	÷18361	45 8∞.	(12):1-8x9 LG	(24)-1-8 ==4
16"	1116	91630	42%	1730	127/16	(16) 1-8x114.G	132)=T-8

*USES SPOOL PIECE

DDITIONAL AIR VALVE IN		BULLETIN
-3 ALVES	USE? URBINE PUMPS CUUM VALVES ED AIR AND VACUUM VALVES	23 86

ON SIZES 4" AND LARGER THE PLAIN OUTLET (
PROTECTOR HOOD, AS ILLUSTRATED HOWEVER T
FLANGED OUTLETS ARE AVAILABLE AND REC
WHEN VALVES ARE USED INSIDE THE PUMP HOL

C-II-3

TRUE UNION SAFE BLOCK BALL VALVES

ADVANTAGES:

- Unique capsule design truly maintenance frèe
- · Double block feature
- Dual end connectors maximum installation versatility
 Pressure rated 50 psi at 73°F

LIMITED WARRANTY

If this valve fails under normal operating conditions within one year of purchase, the manufacturer will replace the valve capsule FREE of charge, provided the valve is returned to them accompanied by a report stating the actual condition of the failure.

FEATURES:

- Full port on 1/4"-4" size
- · Blow-out proof bottom entry stem
- · All sizes rated for vacuum service

OPTIONS:

- Stem extensions
- · 2" square operating nut
- TEFLON encapsulated O-ring kits
- Spring return handles
- · Mounting pads for actuators
- Locking handles



PVC. (MAXIMUM TEMPERATURE 140°F)

SIZE (IN.)	SOC. PART NUMBER	THD. PART NUMBER	PRICE EACH (\$)	FLANGED PART NUMBER	PRICE EACH (\$)
1/4	BV10025S	BV10025T	26.75		
3/8	BV10037S	BV10037T	26.75		
1/2	BV10050S	BV10050T	26.75	BV10050F	39.00
3/4	BV10075S	BV10075T	31.00	BV10075F	47.00
1	BV10100S	BV10100T	38.00	BV10100F	55.00
1-1/4	BV10125S	BV10125T	50.00	BV10125F	73.00
1-1/2	BV10150S	BV10150T	62.00	BV10150F	91.00
2	BV10200S	BV10200T	82.00	BV10200F	119.00

NOTE: Prices shown above are for valves with VITON O-rings. EPDM O-rings available on request.

CPVC, (MAXIMUM TEMPERATURE 200°F)

SIZE (IN.)	SOC. PART NUMBER	THD. PART NUMBER	PRICE EACH (\$)	FLANGED PART NUMBER	PRICE EACH (\$)
1/2	BV20050S	BV20050T	37.00	BV20050F	62.00
3/4	BV20037S	BV20037T	46.00	BV20037F	76.00
1	BV20050S	BV20050T	56.00	BV20050F	88.00
1-1/4	BV20075S	BV20075T	79.00	BV20075F	130.00
1-1/2	BV20100S	BV20100T	93.00	BV20100F	144.00
2	BV20125S	BV20125T	129.00	BV20125F	199.00

NOTE: Prices shown above are for valves with VITON O-rings, EPDM O-rings available on request.

TRUI

2 Ball Valves

3 SIZES

140°F)

E 1	FLANGED PART NUMBER	PRICE EACH (\$)	C, VALUES GAL/MIN. @ 1 PSI
7	BV10300F	271.00	480
0	BV10400F	429.00	600
	BV10600F	792.00	600

as shown are for valves with VITON ble upon request.



Drain Valves for Dual Containment Piping

: 200°F)

-		, analysis	• [FLANGED PART NUMBER	PRICE EACH (\$)	C, VALUES GAL/MIN. @ 1 PSI
3	BV20300S	BV20300T	369.00	BV20300F	517.00	480
4	BV20400S	BV20400T	633.00	BV20400F	858.00	600

NOTE: 1. 4" valve ventured. Prices shown are for valves with VITON O-rings, EPDM O-rings available upon request.

COMPLETE VALVE ACTUATION PACKAGES AVAILABLE FOR VALVES SHOWN ABOVE. CALL YOUR LOCA: 1 TE INFORMATION.



227

CHECK VALVES

POSI-CHECK CPVC SWING CHECK VALVE

Use this valve for positive prevention of backflow in highly corrosive materials. Solids in suspension can be handled with ease while maintaining flow rates and pressure drops the same as an equivalent length of pipe. The angled EPDM seat and CPVC weighted flapper design requires approximately 1/2 PSI or 1.5 foot of water column to seal. Short laying length facilitate easy installation in tight spaces.



SIZE (IN.)	PART NUMBER	PRICE (\$)
1	H1520CP-100FL	24.75
1-1/4	H1520CP-125FL	24.75
1-1/2	H1520CP-150FL	26.25
2	H1520CP-200FL	40.75
3	H1520CP-300FL	75.00
4	H1520CP-400FL	106.25

PVC SPRING CHECK VALVES

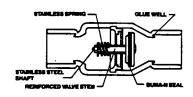
- Swimming Pools
- Industrial Application
- Hot Tubs
- Potable Water
- · Spas
- Solar Systems

SIZE (IN.)	FPT X FPT PART NUMBER	SOC X SOC PART NUMBER	PRICE EACH (\$)
1/2	1001-05FL	1011-05FL	6.20
3/4	1001-07FL	1011-07FL	6.35
1	1001-10FL	1011-10FL	9.65
1-1/4	1001-12FL	1011-12FL	12.35
1-1/2	1001-15FL	1011-15FL	13.15
2	1001-20FL	1011-20FL	19.25

NOTE: 2 lb. spring available on request.

Chatter or turbulence found in other check valves is reduced or eliminated by these valves. The exclusive vane system that controls flow through the valve plus the angled seat with Buna-N assures a positive seal against backflow everytime. The valves are available in socket or threaded ends.

3



- 1/2 LB. SPRING STANDARD
- MAINTENANCE FREE
- · POSITIVE BUNA-N-SEAL



- PRESSURE RATED AT 200 PSI
- REDUCED CHATTER
- NSF LISTED SE-14 FOR POTABLE WATER SERVICE

Use in irrigation systems, and for preventing t materials in waste water lines, sump pump dispistations or ejector systems. Use also where min is required

3 Check Valves



PVC, soc x soc

SIZE (IN.)	PART NUMBER	PRICE EACH (\$)			
1-1/4	1520-12FL	9.90			
1-1/2	1520-15FL	10.45			
2	1520-20FL	16.25			
3	₹-1520-30FL	30.00			
4	1520-40FL	42.50			

CLOG PREVENTION AREA ightharpoonup

- · No metallic parts, corrosion resistant.
- Full flow design.
- PVC weighted and shielded flapper will retain back pressure up to 125 psi.
- Designed for both horizontal or vertical usage.
- · Pressure rated 125 psi at 72°F.

PVC BODY - COMPRESSION

SIZE (IN.)	PART NUMBER	PRICE EACH (\$)
1-1/4	1500-12FL	14.45
1-1/2	1500-15FL	16.10
2	1500-20FL	25.45
3	1500-30FL	47.35

FOOT VALVE SCREEN

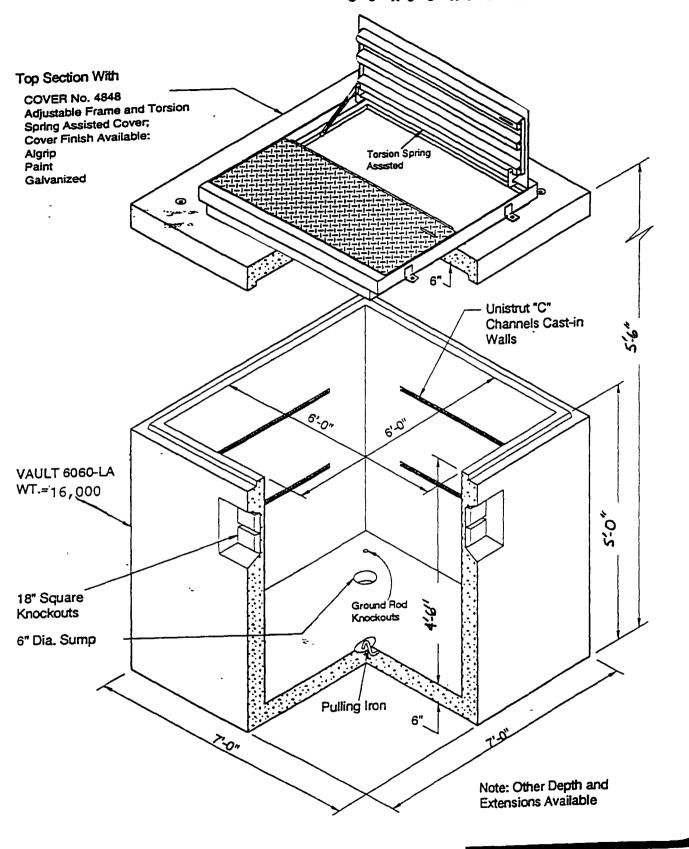
This foot valve screen may be threaded directly into the intake side of any threaded valve, converting it to a dependable foot valve. The screens are produced from a high-density polypropylene and are self-cleamning 100 mesh.

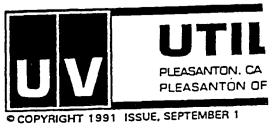


SIZE (IN.)	PART NUMBER	PRICE EACH (\$)
1/2	1800-05FL	.60
3/4	1800-07FL	.65
1	1800-10FL	.95
1-1/4	1800-12FL	1.20
1-1/2	1800-15FL	1.25
2	1800-20FL	2.80

C-II-5

6060-LA 6'-0" x 6'-0" x 6'-0" I.D. VAULT





4 Concrete Vaults

ULT CO.

• FONTANA, CA • WILSONVILLE, OR 183 • FAX NO. (510) 846-4904

C-II-6

PVC SCHEDULE 80 PIPE

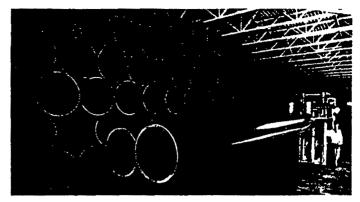
SPECIFICATIONS

ASTM: The material used in the manufacture of pipe for Ryan Herco Products Corp. will meet ASTM-D-1784-65T for a PVC Type 1 material. The Schedule 40 and Schedule 80 Pipe conforms to ASTM-D-1785.

CS (Commercial Standard): CS-207-60 is the industry standard for Schedule 40 and Schedule 80 PVC pipe and is met by pipe from the Ryan Herco Products Corp. in both schedules. PVC pipe meeting this specification has the same O.D. and I.D. as the corresponding schedule of iron or galvanized pipe.

All PVC pipe except 1/8", 1/4" and 3/8" sizes are NSF-approved for potable water.

NOT RECOMMENDED FOR COMPRESSED AIR OR GASES



3905-(Size No.) PVC HEAVY WALL PIPE, SCHEDULE 80 3907-(Size No.) HARVEL HIGH QUALITY PVC, SCHEDULE 80

Standard Length: 20 ft.

	Nom.			Min.			Price p	er Foot
Size No.	Pipe Size (in.)	O.D. in. (mm)	Avg. LD. in. (mm)	Wall Thick. In. (mm)	Nom. Wt. (lbs./ 100 ft.)	Max. Work Pressure (psi)*	3905	3907
001 -002 -003	1/8 - 1/4 - 3/8 -	0.405 (10.3) 0.540 ± (13.7) 0.675 (17.1)	0.203 (5.2) 0.282 (7.2) 0.403 (10.2)	0.095 (2.4) 0.119 (3.0) 0.126 (3.2)	5.8 9.8 13.6	1225 1130 920	\$.42 51 .70	\$.75 1.06 1.43
-005 -007 -010	1/2 3/4 1	0.840 (21.3) 1.050 (26.7) 1.315 (33.4)	0.526 (13.4) 0.722 (18.3) 0.935 (23.7)	0.147 (3.7) 0.154 (3.9) 0.179 (4.5)	20.5 27.8 40.9	850 690 630	.33 .45 .66	.42 .57 .83
	1-1/4 1-1/2 = 2	1900 (48.3) 2375 (60.3)	1000	07.01 (09) 0.200 (5-1) 0.218 (5.5)	56.6 68.5 92.8	520 470 400	.913 1.11 21.53	71.15 1.37 1.91
-025 -030 -040	2-1/2 3 4	2.875 (73.0) 3.500 (88.9) 4.500 (114.3)	2.291 (58.2) 2.864 (72.7) 3.786 (96.2)	0.276 (7.0) 0.300 (7.6) 0.337 (8.6)	144.8 193.7 283.1	420 370 320	2.33 3.12 4.55	3.06 3.89 5.69
930	5.8		100 Stan	0.50 (127)		280 280 240	9.65 8.70 33.37	9.65 \$10.85 \$18.44

SCH. 80 LARGE-DIAMETER PROCESS PIPE

TEN TEN	5 10 12	0 000 2000	(Gear	U SERVER	(RES) 15	0.5%				19.80	\$27.84 38.27
-140	14	14.000	(355.6)	12.410	(315.2)	0.750	(19.1)	1979.0	220		53.42
-160	16	16.000	(406.4)	14.214	(361.0)	0.843	(21.4)	2543.0	220	_	87.31
-180	18	16.000	(457.2)	16.014	(406.8)	0.937	(23.8)	3183.0	220	_	84.25

^{*}The maximum working pressure is calculated at 73°F. See General Information Section to derate for higher temperatures. Minimum available quantity is one length.

HARVEL HIGH QUALITY PVC SCHEDULE 80 PIPE

- Highest quality best appearance.
- · Cosmetic applications.
- Special storage and shipping.

More than 30 years of thermoplastic processing experience makes Harvel pipe the leader in quality product. Only the finest domestic raw material compounds are selected and carefully blended to assure consistent physical properties from run to run. State-of-the-art processing and testing equipment are combined with comprehensive quality assurance programs to meet industry expectations. To further insure quality, unannounced inspections are conducted routinely by independent third parties such as NSF and UL.

Harvel's technical team provides reliable answers to tough questions regarding material selection, product applications system

duct is ection, uperior

Discharge Piping











HDPE PIPING

ORDER INFORMATION & PIPE DATA

ORDER INFORMATION

To assure expedient handling, please state:

PIPE OR TUBING FOOTAGE; IPS OR CTS SIZE; SDR OR MINIMUM WALL; COIL LENGTH OR STRAIGHT LENGTH; DESIRED SHIPPING DATE AND DESTINATION.

Minimum Order: \$100.00

Please send orders to:

P. O. Box 608 State Highway 32 Abbeville, SC 29620 (803) 446-2136

1280 Jefferson Lane Colton, CA 92324 (714) 370-1881

701 E. Highway 31 praicana. TX 75110 (03) 874-5622

1806 West Stone Avenue Fairfield, IA 52556 (515) 472-3137

Or: P. O. Box 23530 Knoxville, TN 37933 (615) 966-5822

Other sizes and SDR's are available on special order. Write or call for price and delivery.

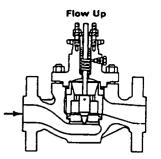
All orders are subject to PLEXCO acceptance and current conditions of sale.

PACKAGING DATA

SILO PACK is a vertical stack of colla strapped to a nonreturnable pallet.
BULK PACK is a rectangular bundle of straight lengths of pipe secured with wood members and strapping.
SILO PACKS and BULK PACKS may be combined when feasible to achieve Truckload requirements.

		PE & TU	BING]			
NOMINAL	1	1	STOCK	PIPE			POUNDS
- SZE	Sile	Selle.	Ninemen.	0.07			
1/2° CTS	7.0	500	947907	.625"	.439*	.090"	.07
		100Ò	947915				
3/4" CTS	9.7	500	947923	.875"	.685*	.090*	.10
1º CTS	11.0	500	947958	1.125*	.911"	.102"	.14
1- CIS	12.5	500	947931	1.125"	.935*	.090"	.13
1-1/4" CTS	15.3	500	947966	1.375"	1.185"	.090"	.16
1/2" IPS	9.3	1000	947974	.840"	.650"	.090"	.09
3/4" IPS	11.0	500	947982	1.050*	.848"	.095"	.12
1" IPS	11.0	500	948029	1.315"	1.061"	.119"	.19
1-1/4" IPS	11.0	500	948045	1.660*	1.340	.151"	.31
2" IPS	11.0	350	942137	2.375"	1.917"	.216	.64
		500	942145				•
		1500	942153				
3" IPS	11.0	500	948141	3.500"	2.856"	.318"	1.39
		1000 -	901836				_

STR	AIGHT	LENG	THS				
			S. O. O.	TOTAL PROPERTY AND ADDRESS OF THE PARTY OF T	313.9 (•)		
SIVAST.	STATE	arkyles o:	NO MER			2.5	
2" IPS	11.0	20	902330	2.375"	1.917"	.216"	0.64
3" IPS	11.0	40	948168	3.500°	2.826*	.318"	1.39
4" IPS	11.0	40	948192	4.500*	3.632"	.409"	2.30
4" IPS	13.5	40	948213	4.500*	3.794*	.333"	1.90
6" IPS	11.0	40	948256	6.625"	5.349°	.602"	4.97
6" IPS	13.5	40	948272	6.625"	5.585°	.491"	4.13
8" IPS	11.0	40	948301	8.625"	6.963°	.785*	8.43
S" IPS	13.5	40	948328	8.625*	7.271"	.639"	7.00
12" IPS	11.0	40	900554	12.750"	10.293*	1.160"	18.43
12" IPS	13.5	40	900558	12.750"	10.749"	.945°	15.31



For additional information on the Design EZ valve with integral end connections, see Belletie \$1.1:EZ (10).

FLOW COEFFICIENTS

Mic	Micro-Form Equal Percenta Characteris											atage ristic		
Coeffi- cients	Body Size, In.	Port	Total Travel, In.	Valve Opening—Percent of Total Travel									Km°	
		Dismeter, In.		10	20	30	40	50	60	70	80	90	100	and C ₁
C _V (Liquid)	Ali Sizes 1/2-2	1/4	3/4	.076	.112	.158	.224	.320	.455	.641	.910	1.22	1.49	.60
	1/2	3/8 1/2	3/4 3/4	.129 .164	.226 .312	.337 .474	.440 .693	.602 1.06	.884 1.52	1.26 2.12	1.71 3.03	2.13 4.11	2.39 4.47	.86 .85
	3/4	3/8 1/2 3/4	3/4 3/4 3/4	.133 .168 .405	.229 .312 .639	.334 .482 .963	.448 .698 1.40	.630 1.06 2.05	.897 1.56 2.99	1.35 2.24 4.32	1.91 3.26 6.21	2.58 4.38 8.15	3.18 5.21 9.00	.90 .83 .81
	1	3/8 1/2 3/4	3/4 3/4 3/4	.120 .130 .375	.228 .308 .618	.331 .464 .952	.438 .697 1.43	.620 1.04 2.05	.903 1.55 2.96	1.29 2.11 4.14	1.79 3.12 6.31	2.45 4.21 8.39	3.04 4.94 9.86	.80 .81 .86
	1-1/2 and 2	3/8 1/2 3/4	3/4 3/4 3/4	.120 .130 .390	.228 .308 .610	.331 .464 .950	.438 .697 1.43	.620 1.04 2.05	.903 1.55 3.01	1.29 2.11 4.48	1.79 3.12 6.80	2.45 4.21 9.43	3.04 4.94 11.5	.80 .81
	All Sizes 1/2-2	1/4	3/4	1.93	2.95	4.45	6.39	9.20	13.1	18.6	26.6	37.2	48.4	31.8
Ì	1/2	3/8 1/2	3/4 3/4	4.06 4.96	7.03 9.54	10,3 13.6	13.7 22.1	18.9 32.5	27.3 46.1	38.2 65.0	54.0 96.3	71.5 136	86.7 160	36.3 35.8
Cg (Gas)	3/4	3/8 1/2 3/4	3/4 3/4 3/4	4.09 5.63 13.6	7.19 9.70 20.3	10.2 15.1 29.4	13.5 21.6 43.0	19.4 32.2 63.3	28.0 47.2 93.0	40.8 67.4 137	58.9 96.8 203	80.9 135 270	109 176 323	34.J 33.8 35.9
	1 '	3/8 1/2 3/4	3/4 3/4 3/4	3.80 4.82 13.0	7.18 9.65 19.7	10.3 15.2 30.3	13.6 21.7 44.2	19.2 32.0 63.5	28.0 46.9 93.8	40.0 67.7 139	56.2 95.6 207	78.0 134 285	104 179 365	34.2 36.2 37.0
	1-1/2 and 2	3/8 1/2 3/4	3/4 3/4 3/4	3.80 4.82 12.8	7.18 9.65 19.8	10.3 15.2 30.0	13.6 21.7 44.8	19.2 32.0 65.5	28.0 56.9 96.2	40.0 67.7 142	56.2 95.6 210	78.0 134 295	104 179 383	34.2 36.2 33.3
	All Sizes 1/2-2	. 1/4	3/4	.097	.148	.223	.320	.460	.655	.930	1.33	1.86	2.42	31 8
	1/2	3/8 1/2	3/4 3/4	.203 .248	.352 .477	.516 .680	.685 1.10	.945 1.62	1.37 2.30	1.91 3.25	2.70 4.82	3.58 6.80	4.34 8.00	36.3 35.8
C _s (Steam)	3/4	3/8 1/2 3/4	3/4 3/4 3/4	.205 .282 .681	.360 .485 1.02	.510 .755 1.47	.675 1.08 2.15	.970 1.61 3.17	1.40 2.36 4.65	2.04 3.37 6.86	2.95 4.84 10.2	4.05 6.75 13.5	5.45 8.80 16.2	36.3 33.8 35.9
	1	3/8 1/2 3/4	3/4 3/4 3/4	.190 .241 .650	.359 .482 .985	.515 .761 1.52	.680 1.08 2.21	.960 1.60 3.18	1.40 2.34 4.69	2.00 3.38 6.95	2.81 4.76 10.4	3.90 6.71 14.3	5.20 8.95 18.3	34.2 36.2 37.0
	1-1/2 and 2	3/8 1/2 3/4	3/4 3/4 3/4	.190 .241 .640	.359 .482 .990	.515 .761 1.50	.680 1.08 2.24	.960 1.60 3.28	1.40 2.34 4.81	2.00 3.38 7.10	2.81 4.78 10.5	3.90 6.71 14.8	5.20 8.95 19.2	34.2 36.2 33.3

This column lists the K_{m} viscoefficients at 100% travel.

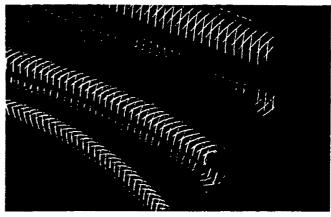
Globe Valves

BRAIDED POLYURETHANE HOSE



- Withstands oil, grease, fuels and many chemicals.
- · Abrasion-resistant.
- Low-temperature flexibility.
- Contains no plasticizers.
- Resistant to weather, ozone, and radiation.
- Smooth inner and outer surfaces.

Now you can employ the combination of superior abrasion resistance and higher working pressures, with Ryan Herco's braided polyurethane hose. It's not only far stronger than unreinforced tubing; it is an ether-based, not ester-based, urethane, providing superior resistance to moisture and fungus. Its incredible low-temperature flexibility outperforms braid-reinforced vinyls as well. Because of the dual extrusion, barbed insert fittings (not compression type) are recommended.



ORDER: 0580-(Size No.) BRAIDED POLYURETHANE HOSE, 100 ft. coils

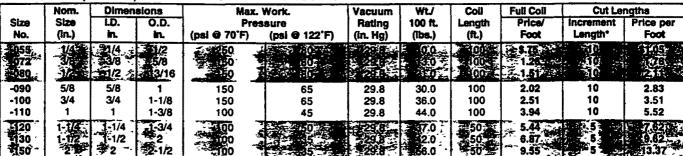
	Nom.	Dimensi	ons	Max. Work.	Wt./	Full Coil	Cut Le	ngths
Size	Size	I.D.	O.D.	Pressure	100 ft.	Price/	Increment	Price per
No.	(in.)	_ in. (mm)	in.	(psi @ 70°F)	(ibs.)	Foot	Length*	Foot
÷ -055	1/4	1/4 (6.35)	.472	÷ 250	39. 0	\$1.87	美國0 東	华\$2.62
-072	3/8	3/8 (9.53)	.630	190	12.0	2.66	370	3.72
-080	1/2	1/2 (12.7)	.748	150	5.0	3.37	3.10	4.72
-090	5/8	5/8 (15.9)	.906	130	` 20.0	4.59	10	6.43
-100	3/4	3/4 (19.1)	1.024	100	23.0	5.21	10	7.29
-110	1	1 (25.4)	1.300	80	47.0	7.59	10	10.63
-120 -130 -150	1-1/4	1-1/4 (31.8)	1.710	75	34.52.0	3.58	EE 6 30.	19.01
%-130	1-1/2	1-1/2 (38.1)	1. 9 29	£ 450 F	72.0	14.83	# 15 A	20.76
晋-150	差 .2	2 (50.8)	2.519	2 4 40 = J	0.00	≥ 36.80	3 25 20	5 C52

[&]quot;Smallest cut increment available for a given tubing size.

HERCO-FLEX WIRE-REINFORCED PVC TUBING

- Spiral steel wire reinforcement incorporated within the walls of flexible PVC tubing.
- Made from non-toxic ingredients conforming to FDA standards. NSF approved for potable water.
- · Kink- and crush-resistant.
- Handles both positive and negative pressures.
- The glass-like clarity on the mirror-smooth surface provides outstanding visual flow characteristics.
- · Lightweight, yet tough and abrasion-resistant.
- Full vacuum transfer hose.

ORDER: 0518-(Size No.) WIRE-REINFORCED PVC TUBING



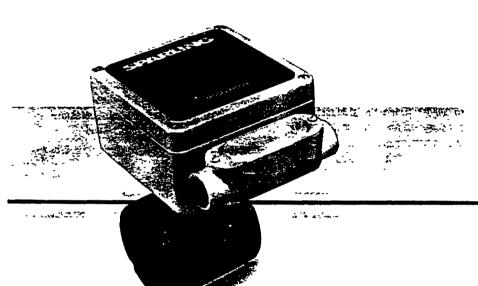
^{*}Smallest cut increment available for a given tubing size 1/4" - 1" tubing, 100 ft. coils. 1-1/4" - 2" tubing, 50 ft. coils.













FOR IRRIGATION AND OTHER WATER MONITORING APPLICATIONS



9 Magnetic Flow Meters

Predictable Pe

C-II-11

c Flowmeter



Sparling Instruments Co., with seven decades of flowmeter experience, has produced a low cost, multi-purpose meter that combines simplicity and reliability to accommodate a wide range of conductive applications.

The Sparling Model 621 Waterhawk electromagnetic flowmeter is an obstructionless. Jow-maintenance alternative to mechanical flow devices. This wafer-style meter offers the user economical flow monitoring with all-electronic performance made possible by Sparling's bi-polar pulsed dc technology.

You can consider the Waterhawk for liquids with conductivities as low as 20 micromhos/cm.

The Waterhawk's standard configuration is a blind transmitter, but it is also available with LCD digital flow rate indicator and eight-digit flow totalizer.

The Waterhawk's performance is independent of liquid density, temperature, viscosity or pressure. The simple design allows you to install the meter quickly with unskilled personnel. It's virtually maintenance-free. Set it and forget it.

- · No Nonsense Reliability
- Proven Technology

Unequaled Customer Support

The electronics transmitter, housed in a

he Waterhawk is a flangeless meter for pipe sizes 1" to 8" in diameter and can be installed between AWWA, ANSI, DIN, BS. AS, or JIS flanges.

The rugged flow sensor is constructed of cast ductile iron protected by a tough polyurethane liner for excellent corrosion and abrasion resistance.



Stainless steel electrodes are standard, but several other high-tech choices are available. The Waterhawk resists scale buildup and eliminates the need for expensive electrode cleaners. A high-input impedance circuit assures optimum signal to noise ratios.

Built-in grounding electrodes make it unnecessary to install costly grounding rings or straps in most applications utilizing metallic piping.



You can equip the Waterhawk in four different configurations:

- 1. As a blind transmitter with analog and/or optional pulse or frequency output.
- 2. With an optional LCD flow rate indicator.
- 3. With an optional 8-digit totalizer.
- 4. With both flow rate indicator and totalizer.

The Waterhawk Includes These Value-Added Features:

- Isolated Analog Output
- **Built-In Grounding Electrodes**
- Positive Zero Return
- Adjustable Damping
- Low Flow Cut-Off

The Waterhawk is protected by a Two-Year Warranty.



NEMA 4X cast aluminum enclosure, is mounted on the flow sensor horizontally as standard. It can be remote mounted when application conditions dictate. Vertical transmitter mounting is available as an option The electronics are completely interchangeable throughout the size range.



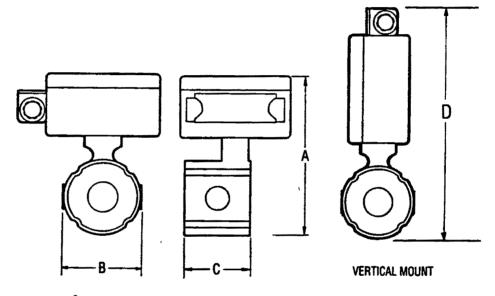
An isolated 4-20 mA output proportional to flow can be interfaced with a chart recorder or remote mounted indicator. The optional 24 Vdc pulse or frequency output is easily connected to an external device.

Applications include well monitoring, waste water, cooling water, potable water and many other less corrosive liquids.

C-II-12

		WA	TERHAW	K Flow a	nd Dimen	sional	Data		D VERTICAL MOUNTING 12.09 13.65 15.28 16.62 19.12
1	Nomina	Meter Size		Gallons Per Minute) *	Din	nensions in in	ches	
╛	(MM)	(INCHES)	±2% above 1 fps	Min. full scale	Max. full scale	A	В	С	0
			1FPS	3FPS	33FPS				
	25	10	16	48	53	7.69	2.92	4.06	12.09
	50	2.0	7	21	231	9 25	4.25	4 06	13 65
	80	3.0	20	60	660	10 58	5.40	6.06	15.28
	100	4.0	35	105	11 5 5	12.22	6.60	6.06	16.62
	150	6.0	88	264	2910	14.60	9.00	8.00	19.12
	200	8.0	147	441	4850	16.65	10.70	8.00	21.37

^{*} Gallons per minute calculated at actual meter ID



Standard Specifications

Full Scale Range	From 0-3 to 0-33fps (0-10 mps).
Accuracy (Freq. Output)	±2.0% of rate 1-33 fps (.3-10 mps). ±0.02 fps below 1.0 fps regardless of full scale.
Repeatability	±0.2% full scale.
Outputs	Isolated analog 4-20 mAdc into 800 ohms (Scaled pulse or frequency optional).
Power Requirements	100, 117, 230 Vac ±10% 50/60 Hz. (24 Vdc optional 4 wire)
Power Consumption	Less than 25 VA
Transmitter	Cast aluminum with corrosion resistant epoxy coating. Integral or remote mounted. NEMA 4X (Remote mount req'd. >158°F (70°C).
Flow Sensor Housing	Cast ductile iron with corrosion resistant epoxy epoxy coating.
End Connections	Flangeless: Requires installation between ANSI, AWWA, DIN, BS, AS or JIS flanges. Grounding rings may be required.

Environmental Rating NEMA 4X hose-down proof. Electrical RatingGeneral Purpose. Positive Zero Return. Drives output to zero at no-flow conditions. Pre-amp Impedance 10¹² ohms minimum. Ambient Temperature.....-20° to 120°F (-30° to 49°C). Electrodes LinerPolyurethane. Conductivity Minumum 20 micromho/cm. **Options** - Flow rate indicator/totalizer.

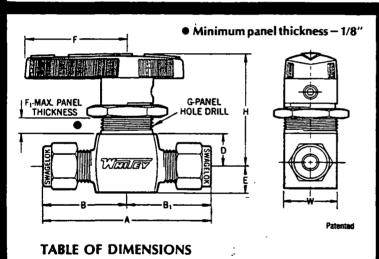
- . Electrodes: (Titanium, Tantalum, Zirconium, Hastelloy C).
- Remote mounted transmitter >158°F (70°C).
- . Vertical transmitter mounting.
- . Mounting hardware and gaskets.
- 24 Vdc power supply 4 wire.
- ±1.0% rate calibration.
- · Scaled pulse/frequency output.

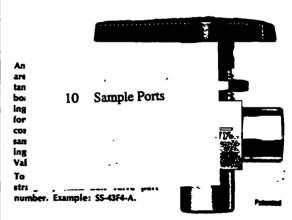
Submergence proof sensor construction

BALL VALVES FOR ON-OFF SERVICE

TECHNICA	L DATA		M	AXIMUM I	FLOW RAT	E]	
		.Р	ressure D	rop To At	mospher	e (∆ P) P	SI]	
			CFM of A 70°F (21°		GI	PM of Wa 70°F (21°	ter °C)		
Catalog Number	Čv	10	50	100	10	_50	100	Pressure Rating @ 70°F (21°C)	Temperature Rating
-41 S 2	0.2	2.7	7.6	13.5	0.6	1.4	2.0	2500 PSI (17,200 kPa)	
-42F2	0.5	6.9	19.1	33.9	1.5	3.5	5.0		
-42\$4	0.6	8.3	22.9	40.6	1.9	4.2	6.0		
-43F2	1.2	16.6	45.9	81.3	3.7	8.4	12.0		
-43F4	0.9	12.4	34.4	61.0	2.8	6.3	9.0	0000 001	
- 43M4-S4	1.6	22.1	61.2	108.4	5.0	11.3	16.0	3000 PSI	
-4354	2.4	33.2	91.8	162.7	7.5	16.9	24.0	(20,600 kPa)	+50° to 150°F
-4356	1.5	20.7	57.3	101.7	4.7	10.6	15.0	1	(+10° to 65°C)
-44F4	3.0	41.5	114.7	203.4	9.4	21.2	30.0		
- 44F6	2.6	35.9	99.4	176.3	8.2	18.3	26.0		
-44S6	6.0	83.0	229.5	406.8	18.9	42.4	60.0	2500 PSI	
- 45F8	6.3	87.1	240.9	427.1	19.9	44.5	63.0	(17,200 kPa)	
-45 \$8	12.0	166.0	458.9	813.7	37.9	84.8	120.0		
-45S12	6.4	88.5	244.8	433.9	20.2	45.2	64.0		

Standard valves are factory set for 1000 PSI (6800 kPa) working pressure.





NOTE: For dimensions, see table on page 5 (except dim. "A").

`							1							
Bail \	Valves	11	Connec	ction Size					Dim	nensions	1			
Catalog	Orli		Inlat	Outles					T	<u> </u>			1	—
Number*	in.	mm	Inlet	Outlet	A	В	В,	D	E	F	F,	G	H	W
-41S2	.093	2.4	% SWAGELOK	% SWAGELOK	2%.	11/22	11/22	11/22	722	1%	74	19/22	111/20	7,0
	.125	3.2	% Female NPT	% Female NPT	1%	17/16	17/10	11/22	%z	1%	74	19/32		7.0
	.125	3.2	1/4 SWAGELOK	1/2 SWAGELOK	21/4	1%	1%	11/2.2	722	1%	4	19/22	111/2	7,0
	.187	4.8	1/2 Female NPT	% Female NPT	2	1	1 .	%.	%	117/22	1/4	24/ /32		7,
	.187	4.8	½ Female NPT	1/2 Female NPT	21/10	1 1/2	11/22	7,0	7,	117/32	1/4	24/22		1,
	.187	4.8	% Male NPT	1/2 SWAGELOK	27,	1	17,2	7.0	%	117,2	1/4	25/ /32		7
	.187	4.8	1/4 SWAGELOK	1/2 SWAGELOK	27/10	17/2	17/32	7,0	%	117/22	1/4	25/ /22		7.
	.187	4.8	% SWAGELOK	% SWAGELOK	2%	1%.	1%.	%e	%	117,2	1/4	25/22		7,
-44F4	.281	7.1	1/2 Female NPT	1/2 Female NPT	21/2	11/4	11/4	%•	%.	2	7,	1%	2%•	1%
-44F6	.281	7.1	% Female NPT	% Female NPT	21/2	11/4	11/4	%.	%.	2	7,	1%	21/4	1%
-4458	.281	7.1	% SWAGELOK	% SWAGELOK	31/4	1%.	1%,	%.	%.	2	%	1%	21/10	1%
-45F8	.406	10.3	1/2 Female NPT	½ Female NPT	31/4	1%.	1%,	11/40	11/16	3	%	1%	27,4	1%
-45S8	.406	10.3	1/2 SWAGELOK	1/2 SWAGELOK	31%.	131/32	131/32	11/4.	11/40	3	*	11/2	27,	1%
-45S12	.408	10.3	% SWAGELOK	% SWAGELOK	314.	131/_	131/_	17.	17.	3	1 4	1%	27.	11/4

^{*}For a complete Part Number, add SS for 316 stainless steel or B for brass as a prefix to the Catalog Number.

▶ Dimensions shown with SWAGELOK nuts finger-tight. All Dimensions in inches. Dimensions for reference only — subject to change.

436

Grundfos 🗶 inch Stainless Steel Well Seal

Part No.	Part Name
1B5102	Well Seal



WELL SEALS ARE AVAILABLE
WITH VARIOUS DIAMETERS
AND CONFIGURATIONS

14 Well Seals

PIPE LINE STRAINERS

FOR CORROSION SERVICE

Function: The strainers trap and hold foreign particles that would be detrimental to processing equipment.

In-line service: The strainer element is easy-to-clean, without removing the body of the unit from the line.

Screens: 1/32" perforations are standard in PVC and CPVC. 316 stainless steel screens are available in most perforation and mesh sizes.

- Grav PVC or CPVC
- Viton o-ring seal



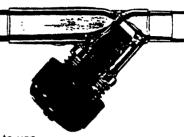
ORDER INFORMATION:

5350-(Size No.) STRAINER, gray PVC threaded 5351-(Size No.) STRAINER, gray PVC socket 5320-(Size No.) STRAINER, Hi-Temp CPVC threaded 5321-(Size No.) STRAINER, Hi-Temp CPVC socket

Size No.	Nom. Pipe Size	Gray PVC	Hi- Temp CPVC
-005	1/2	\$43.40	\$105.00
-007	3/4	48.40	116.00
-010	1-2	52.90	148.00
-012	1-1/4	96.80	-
-015	1-1/2	96.80	231.00
录-020	2.2	114.00	296.00
%-030	₹ %3 %	254.00	370.00
3-040	4	446.00	641.00

CLEAR PVC

See-through body

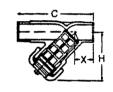


LINE STRAINER

- The spigot end is easy to use.
- The flow and condition of the screen is visible from the outside.
- You have a wide choice of screens—it comes fitted with 20mesh, but screens with 8, 12 or 30-mesh can be ordered separately.

ORDER INFORMATION: 5353-(Size No.) STRAINER, clear PVC, spigot ends

Size	Nominal	PVC Clear
No.	Pipe Size	5353
≈-005	· 1/2	\$34.90
-007	3/4	40.20
-010	1	44.40
-012	1-1/4	77.50
-015	1-1/2	77.50
-020	750 72 75	₹96.10
æ -030	3 -	-194.00



Size (in)	1/2	3/4	1	1-1/4	1-1/2	2	3
\$ C ₹	5.62	6.30	6.83	7.40∓	到。这	8.86	12.23
Н	2.56	3.00	3.56	4.13	4.88	5.81	8 06
家X季.	4:34	1.70	1.72	1.83	100	. 2.36	3.84



15 Y-Strainers



ORDER:5412-(Size No.) FLOAT VALVE, PVC 5413-(Size No.) FLOAT VALVE, polypro

			76
Size	FPT Pipe	5412	5413
No.	Size (in.)	PVC	Potypro
002	J/4	\$90.00	\$108.00
003*	3/8	90.00	108.00
-005	1/2	96.00	115.00
-007		132.00	168.00
-010	1	168.00	198.00
015	2/2	476.00	616.00
		623.00	756.00

* Bushed from 1/2* size. ** MPT fittings.

The PVC or polypropylene construction throughout allows for use with most acids, caustics and distilled and salt water. The EPDM O-ring seals are standard (Viton is available upon request). At ambient temperatures, the maximum operating pressure is 80 psi. At reduced pressures, PVC valve may be used up to 140°F, polypropylene up to 180°F.

FLOAT VALVE FOR RINSE TANKS

- · Saves valuable tank space.
- No lever arm to break.
- No float ball stem to break.
- Easy installation.

No more broken float stems—just a continuous flow of water, automatically—and only when it's needed. When the desired water level is reached, the valve shuts off, positively and automatically. Use in plating rinse tanks or for maintaining water level in any open tank. Do not immerse in strong oxidizing chemicals. These valves are molded of Fiberglass reinforced Nylon and ABS plastic with rub-



ber and stainless internal parts; the 1° female pipe thread connects to the inlet line. Repair kits and replacement parts available - call for details.

ORDER INFORMATION:

5410-010 FLOAT VALVE, 1", threaded \$45.00









P.05

Harmsco Up-flow Cartridge Filtration...

A Design so Superior it's Patented!

Harmsco's up-flow design out performs conventional filters! To understand how up-flow filters work, follow the diagram shown below:

Fluid enters the filter under pressure and flows through the filter media, holes in the center tubes and perforations in the rods that hold the carrindges in place. As the fluid continues its path, it flows upward past

the top seal where it spills over into the standpipe as it hits the filter's domed lid. Notice the top of the standpipe is at the high point of the hiter. Also, note the filter cartridges are sealed at the bottom and held in place with threaded pipe caps on the Harmsco model shown in this diagram. This unique design offers the following significant advantages:

No Air Entrapment During Operation

Air entrapment during operation is eliminated because the outlet (top of the standpipe) is localed at the high point of the filter.

Superior to Conventional Filters

Air accumulation is a common problem with conventional filter designs because their outlets are located below the inlets. Reduced efficiency results since the filter media cannot be utilized where air has accumulated.

No Vents

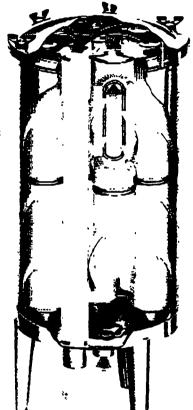
Because air travels upward with the fluid and exits the filter through the standbipe, vents to discharge accumulated air are not required. (If vents are required, lids with vent fittings are available)

Superior Filtration

Since 100% of the media is used 100% of the time, superior filtration is assured!

No Fluid By-pass During Servicing

Fluids cannot by-pass Harmsco filters during servicing because the filter's outlet (top of standpipe) is located above the filter's inlet. A significant advantage in critical filtration applications!



Electro-Polished

All Harmsco Industrial Filters are electro-polished for increased resistance to corrosion.

Fail-Sale Lids

Lids come standard with wing nuts so they may be easily opened without tools. Multiple studs provide fail-safe closure. No single-bott clamp closure used! (HIF-150-FL and HIF-200-FL filters come standard with hex nuts).

Compact Design

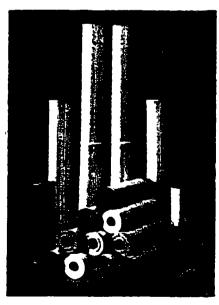
Our compact, space saving design requires less floor space than other filters. We have more cartridges with more filter media than anyone!

Pressure Rated

Harmsco Industrial Filters may be safely used in pressures up to 150 psi.

Cartridge Cluster Filters

Cartridge replacement is made easy with cartridge cluster filters since the entire set of cartridges are removed at one time for quick cartridge changeout or cleaning.



A full line of Harmsco replacement filter cartridges are available for a wide range of applications featuring pleated design for low pressure drop, increased filter area, long filter runs and lower filtration costs.



Harmsen filter cartridges can be cleaned and reused in most applications and most micron ratings. Entire cluster can be cleaned without disassembly, as shown above.



Harmsco filter housings to accommodate 7. 14, 16, 21 and 24 contridges utilize our unique "cartridge cluster" design for easy cartridge removal.



Up-Flow Stainless Steel Industrial Filter Housings

Cartridge filters (304 stainless steel, PVC standpipes, CPVC cartridge holders & caps for temperatures to 140°F.)

Cartridge cluster filters (to remove entire set of cartridges at one time for cleaning or replacement)



Carridge cluster "ter wir" easy carridge removal tocleaning or reciacement











	HIF-7	HIF-16	HIF-16	HIF-21	HIF-24
Flow rate (GPM)	Up to 30	Up to 60	Up to 75	Up to 90	Up to 105
Number of std. cartndges	7	14	16	2 1	24
Alternative cartndge	Single only	7 doubles	8 doubles	7 triples	8 toples
Pipe size (Male NPT)	11/2"	11/2"	2"	11/2"	2"
Filter height	19.5"	28″	28*	37*	37"
Floor space required	13" x 13"	13" x 13"	13" x 13"	13" x 13"	13" x 13"
Service height clearance	35"	48*	48″	68"	68″
Shipping weight (approx.)	29 lbs.	39 lbs.	39 lbs.	50 lbs	50 ibs.
Pressure rating	150 psi	150 psi	150 psi	150 psi	150 psi

Large capacity filters with cartridge lifters for easy cartridge removal



Large capacity wile with ming rocs to remove single stack of carriages











	H0F-42	HIF-75	HIF-100	HIF-150-FL	HIF-200-FL
Flow rate (GPM)	Up to 175	Up to 300	Up to 400	Up to 600	Up to 800
No. of std. cartridges	42	75	100	150	200
Alternative cartridge	14 triples	25 mples	50 doubles	50 toples	100 doubles
Pipe size (Male NPT)	2"	3"	3"	4" flanged	4" flanged
Filter height	40"	42"	52*	48"	58*
Floor space required	18" x 18"	20" x 20"	20" x 20"	28" x 28"	28" x 28"
Service height	68"	70"	87"	76"	93″
Shipping wt. (approx.)	100 lbs.	129 lbs.	188 lbs.	274 lbs.	321 fbs.
Pressure rating	150 psi	150 psi	150 psi	150 psi	150 psi

Note: Wing-nuts standard for lid closure with no tools required. (Hex nuts standard for HIF-150-FL and HIF-200-FL filters.) Patents: Industrial Filters are manufactured under one or more of the following patents. U.S. Patents #3,720.322 and #4,187,179; Canada #977.693, Great Britain #1,372,014. West Germany #26.618.707 France #7.246.884; Hurncane #5,174,896. Other patents pending.

Please see back page for additional information regarding chemical resistant coatings and filters for high temperature applications.



LID REMOVAL WITH WING-NUT CLOSURE

Drain filter housing, remove wing-nuts and lid for easy access to tilter cartridges.



Westates Carbon Dakland

LID REMOVAL WITH **HEX NUT CLOSURE**

Hex nuts are standard with HIF-150-FL and HIF-200-FL models. With these filters, a speed wrench may be used for fast lid removal.

CARTRIDGE INSTALLATION



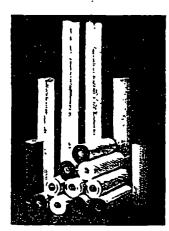
Chuster Filters install cartridges on holding rods and secure with straight thread pipe cap.



High Capacity Filters Install cartridges on cartridge lifters. one stack at a time.

LID REPLACEMENT

Replace wing or hex nuts systematically, working opposite to one another. With wing-nuts, "hand-tight" is normally sufficient. However, in extreme duty applications it may be necessary to tighten to 75 inch lbs. of torque. Over-tightening can cause damage to rim gaskets; do not use pry bars.



HARMSCO® REPLACEMENT FILTER CARTRIDGES

A full line of Harmsco replacement cartridges are available for a wide range of applications, featuring pleated design for low pressure drop, increased filter areas, long filter runs and lower filtration costs

CARTRIDGE CLEANING

Harmsco filter cartridges are cleanable and reusable in most applications and most micron ratings. For best results, clean cartridges when pressure differential is 12-15 psi above start-up differential. If cartridges are to be replaced allow pressure differential to climb to 25-30 psi above start-up differential or when flow has diminished to an unacceptable level, indicating cartridge is at capacity.

Cartridge Cleaning in Aqueous Applications:

Clean cartndges with pressure nozzle using standard hose. Direct spray at an angle to remove particulate. Follow these directions for best results:

Dils in aqueous solution: Soak cartndges in a solution of tri-sodium phosphate or similar strong detergent (2 lbs. to ten gallons of water). Soak up to twelve hours. Rinse after soaking.

Organic matter and algae in aqueous solution: Use tri-sodium phosphate or similar strong detergent as described above, plus one pint of liquid chlorine to kill organic matter and algae. Soak cartndges one hour or longer until surface is no longer slippery. Rinse after soaking.

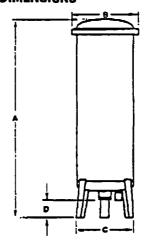
Calcium & mineral deposits: Follow directions for oils described above. Rinse cartridges thoroughly for approximately ten minutes in a solution of one part of munatic acid to twenty parts of water. Rinse cartridge thoroughly with water.

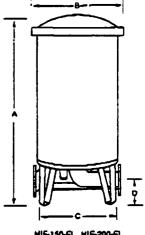
Caution:

Do not runse cartridges with acid until oils and organic matter are removed. Use detergent first and follow with acid soak for mineral removal. Flush cartridges with water after munatic or tn-sodium phosphate baths.

Generally it is not possible to clean Harmsco cartridges when filtering petroleum-base liquids, toxic substances and when using one micron and sub-micron carendoes.

DIMENSIONS





HIF-150-FL HIF-200-FL

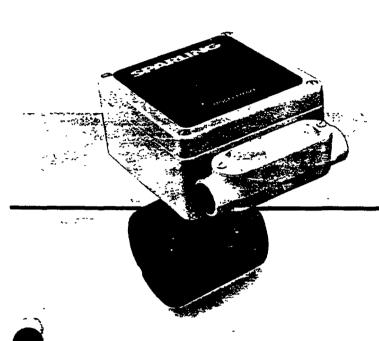
Sporter

Model	A	В	С	D	Ht. Clear	inleV Outlet	Draia
HIF-7	191/2"	13*	13"	31/2"	35″	192" NPT	None*
HIF-14	28*	13"	13*	3 5/16"	48"	11/2" NPT	None*
HIF-16	28″	13*	13~	3 7/8"	48"	2" NPT	1" NPT
HIF-21	37-	13"	13.	31/4.	68*	11/2" NPT	None"
HIF-24	37*	13"	13"	4"	68″	2" NPT	1" NPT
H1F-42	40"	18-	18"	5 3/8"	68″	2" NPT	None"
HIF-75	42"	20"	20*	6 3/8°	70″	3" NPT	None*
HIF-100	52"	20-	20*	5 7/8"	87*	3" NPT	None*
HIF-150-FL	48"	28~	28"	5 3/16***	76"	4" flange	11/2" NPT
HIF-200-FL	58*	28*	28″	5 3/16***	93″	4" tlange	11/2" NPT

* Install tee fitting and valve on inlet for drain (see installation diagrams)

"To center of flanged fitting.







FOR IRRIGATION AND OTHER WATER MONITORING APPLICATIONS



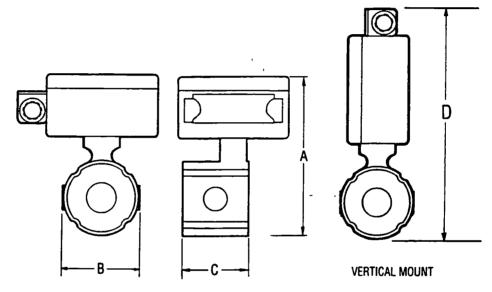
- 2 Effluent Flow Indicator FI-207-1
- 4 Effluent Flow Totalizer FQI-207-1
- 8 Effluent Flow Meter and Transmitter FT-207

C-III-5

ce In A Magnetic Flowmeter

1	Nominal Meter Size			Gallons Per Minute*			nensions in ir	iches	
1	(MM)	(INCHES)		Min full scale	Max full scale	Α	A B		D
			1FPS	3FPS	33FPS				VERTICAL MOUNTING
	25	10	16	48	53	7 69	2 92	4 06	12.09
	50	20	7	21	231	9 25	4 25	4 06	13 65
	80	30	20	60	660	10 58	5 40	6.06	15 28
	100	40	35	105	1155	12 22	6 60	6 06	16.62
	150	60	88	264	2910	14 60	9.00	8 00	19 12
	200	80	147	441	4850	16.65	10.70	8 00	21 37

^{*} Gallons per minute calculated at actual meter ID



Standard Specifications

Full Scale Range ... From 0-3 to 0-33fps (0-10 mps).

Accuracy (Freq. Output) ... $\pm 2.0\%$ of rate 1-33 fps (3-10 mps).

±0.02 fps below 1 0 fps regardless of full scale.

Repeatability ±0.2% full scale

(Scaled pulse or frequency optional).

Power Requirements100, 117, 230 Vac ±10% 50/60 Hz.

(24 Vdc optional 4 wire)

Power ConsumptionLess than 25 VA

coating.

integral or remote mounted.

NEMA 4X (Remote mount reg'd. >158°F

(70°C).

Flow Sensor Housing \hdots ... Cast ductile iron with corrosion

resistant epoxy epoxy coating.

AWWA, DIN, BS, AS or JIS flanges.

Grounding rings may be

required.

Environmental Rating . . . NEMA 4X hose-down proof.

Electrical RatingGeneral Purpose.

Positive Zero Return.....Drives output to zero at no-flow conditions.

Pre-amp Impedance 1012 ohms minimum.

Ambient Temperature -20° to 120°F (-30° to 49°C).

Low Flow Cut-offFixed, 2% FS

Electrodes 316 stainless steel standard (others optional)

Conductivity Minimum 20 micromho/cm.

Options

- Flow rate indicator/totalizer
- Electrodes: (Titanium, Tantalum, Zirconium, Hastelloy C)
- Remote mounted transmitter >158°F (70°C)
- . Vertical transmitter mounting
- . Mounting hardware and gaskets.
- . 24 Vdc power supply 4 wire
- ±1 0% rate calibration.
- Scaled pulse/frequency output
- Submergence proof sensor construction

For further information, request product data sheet PDS-621

C-III-6



Sparing Instruments Co., with seven decades of flowmeter experience, has produced a low cost, multi-purpose meter that combines simplicity and reliability to accommodate a wide range of conductive applications.

The Sparling Model 621 Waterhawk electromagnetic flowmeter is an obstructionless, low-maintenance alternative to mechanical flow devices. This wafer-style meter offers the user economical flow monitoring with all-electronic performance made possible by Sparling's bi-polar pulsed dc technology.

You can consider the Waterhawk for liquids with conductivities as low as 20 micromhos/cm.

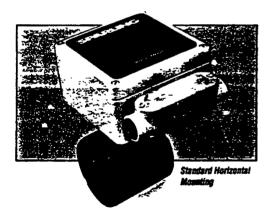
The Waterhawk's standard configuration is a blind transmitter, but it is also available with LCD digital flow rate indicator and eight-digit flow totalizer.

The Waterhawk's performance is independent of liquid density, temperature, viscosity or pressure. The simple design allows you to install the meter quickly with unskilled personnel It's virtually maintenance-free. Set it and forget it.

- . No Nonsense Reliability
- Proven Technology
- Unequaled Customer Support

he Waterhawk is a flangeless meter for pipe sizes 1° to 8° in diameter and can be installed between AWWA, ANSI, DIN, BS, AS, or JIS flanges.

The rugged flow sensor is constructed of cast ductile iron protected by a tough polyurethane liner for excellent corrosion and abrasion resistance.



Stainless steel electrodes are standard, but several other high-tech choices are available. The Waterhawk resists scale buildup and eliminates the need for expensive electrode cleaners. A high-input impedance circuit assures optimum signal to noise ratios.

Built-in grounding electrodes make it unnecessary to install costly grounding rings or straps in most applications utilizing metallic piping.



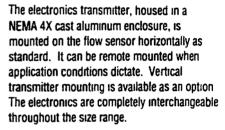
You can equip the Waterhawk in four different configurations:

- As a blind transmitter with analog and/or optional pulse or frequency output.
- With an optional LCD flow rate indicator.
- 3. With an optional 8-digit totalizer.
- 4. With both flow rate indicator and totalizer.

The Waterhawk Includes These Value-Added Features:

- Isolated Analog Output
- Built-In Grounding Electrodes
- Positive Zero Return
- . Adjustable Damping
- . Low Flow Cut-Off

The Waterhawk is protected by a Two-Year Warranty.

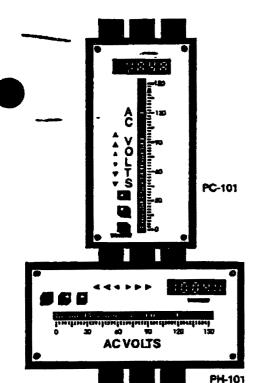




An isolated 4-20 mA output proportional to flow can be interfaced with a chart recorder or remote mounted indicator. The optional 24 Vdc pulse or frequency output is easily connected to an external device.

Applications include well monitoring, waste water, cooling water, potable water and many other less corrosive liquids.

C-III-7



BG Series Edgewise Single BarGraphs ™

The Weschler BG Senes Edgewise Single BarGraphs consist of several 6" size and DIN-size BarGraphs for horizontal and vertical orientation. Specific models are available for direct retrofit applications; contact factory.

Weschler's 101 segment LED BarGraph offers the best of both analog and digital solid state instrumentation. The 101 segment bar display gives you 1% resolution with analog trend indication. The bar display provides the operator with a quick view on the status of the measured signal or control setpoints. The 4-1/2 or 3-1/2 digit display provides the highest accuracy readings of the signal variable. Programming setpoints is accurately and easily accomplished. Weschler's BarGraph family of instruments fits a wide range of input signals and has retrofit sizes where most panel and switchboard meters are being used today. Our instruments satisfy the high quality standards set forth by the utility, OEM and process control industries.

FEATURES

BG-252

High resolution 101 segment LED bar array

Programmable functions

Zero point location
Setpoint location
Hysteresis (setpoint, trend)
Span and zero
Digital display for engineering units
Enable/disable front buttons
I.D. selection for communication

Form-C Relay Outputs

Normally Open

SA, resistive @ 250VAC

5A. resistive @ 28VDC

Normally Closed

3A. resistive @ 250VAC

2A, resistive @ 28VDC

Peak and Valley hold.

Trend indication for signal direction.

Communication

RS232 / 422 / 485 SCADA DCS

Analog retransmit

4-20, 10-50, 0-1mDAC 1-5, 0-1, 0-5 VDC

Retrofft sizes for:

GE/Yokogawa 180, Crompton 128, Dixson SA/BB 101 (ali models), Dixson 8J101, Sigma/International Instruments 1151, Hays Republic 3600/V5A, Foxboro 65PP, Weston 1316.

3-1/2 or 4-1/2 digit display with resolution up to 0.01%.

Most versatile selection of inputs in the industry

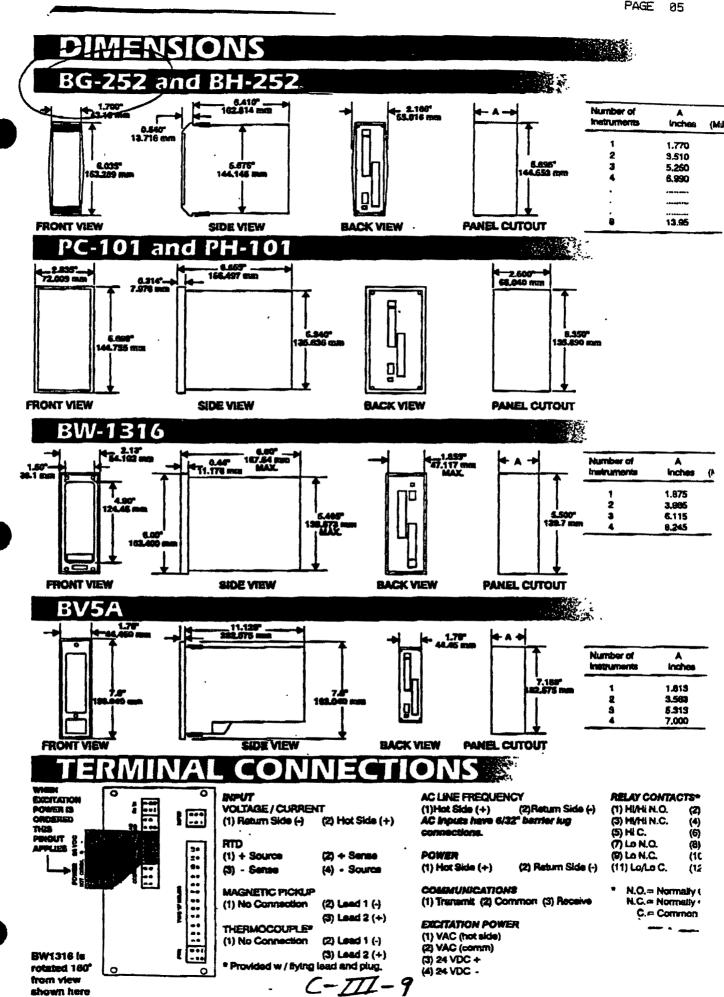
Process Control

C-III-8

Effluent Flow Indicator FI-207-2

BW-1316

BV-SA



Options and features vary between models, contact factory for specifics. and and middlehad enaclfications may change.



Data Recorder Module and Data Transfer Module

May 1991

Data Sheet 14 15

Description

The DRM Data Recorder Module provides a simple and accurate method to collect, store and evaluate process (temperature, pressure, level and flow) data for trending, troubleshooting, alarming and calibration.

The DRM is the ideal replacement for troublesome strip and circular chart recorders lt collects current (e.g., 4-20mA) and voltage (e.g., 1-5V) process signals from signal transmitters, conditioners and other analog devices, and safely stores the collected values in digital form. The DRM then transfers the data directly into a wide range of popular personal computers via an RS-232C format Once downloaded, the menu-driven DRM Support Software is used to display the data in report or graph form. Custom reports and graphs can also be created by transferring the data into compatible data base programs.

For collecting stored data from the DRM without removing the unit from its collection location, Moore Industries offers the DTM Data Transfer Module. The rugged, hand-held DTM collects information from up to 15 DRMs, stores the data, then downloads it into a PC (see back page for details)

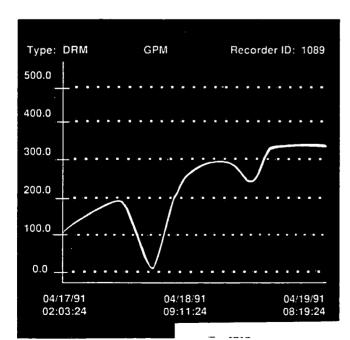
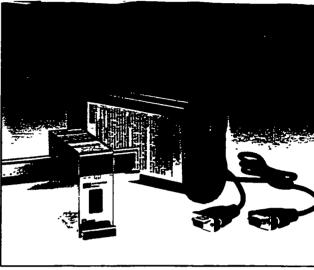


Figure 1. The DRM Support Soft Collected Process Values in Eng

Effluent Flow Recorder FR-207

Low Effluent Flow Switch FSL-207



The DRM Data Recorder Module collects, stores and directly transfers process data into a PC for playback and analysis

Features

- Digital data collection and transfer. Performs safe and accurate data collection while reducing costs by eliminating the need to perform timeconsuming and often inaccurate manual paper-tocomputer data transfer.
- Compatible with popular computers. Using the DRM Support Software, the DRM downloads directly into a wide range of popular PCs for instant data readout and analysis Custom reports and graphs can be created using popular data base programs.
- Battery- or externally-powered. Internal batteries provide unattended operation for a minimum of three years making the DRM ideal for use in remote and hard-to-get-at locations. The recorder will also operate indefinitely from an external Vdc power supply.
- Time stamps data. When collected, data is automatically time stamped to make precise tracing and identification of individual process events fast and simple.
- Loop integrity protection. The 4-20mA input DRM incorporates a removable terminal block with a diode assembly to allow removal of the DRM without interrupting the current loop.

Operation

The DRM Data Recorder Module converts a current or voltage loop input into a series of values which are stored in a secure solid state memory. Sampling the input once per second, the DRM can store up to 6,512 minimum, average or maximum sample values (i.e., MIN, AVG or MAX, or all at the same time, or MAX + MIN, MIN + AVG, or MAX + AVG) at userdefined intervals. The interval can be selected within a range from once per second to once every eight hours. If memory capacity is set for 6,512 average values and the recording period is set for once per minute, the DRM can record up to 108 5 hours

The DRM can then be removed from its collection location and plugged into the serial communications port of a host computer via an RS-232 interface. The data may also be collected from the DRM using the DTM Data Transfer Module (see back page for details)

*The DRM can perform square root extraction and has an accumulator which is incremented every second by the current reading. It also has an alarm logging function that can be turned on or off where the DRM does not record until the input exceeds an alarm set point.

Support Software

Moore Industries' user-friendly DRM Support Software retrieves data directly from the DRM or from the DTM. Using the transferred information, the software performs the computations necessary to store and display graphs and print out the time stamped data records.

The software is also used to initially program the DRM. By processing user-entered menu choices, the software sends the proper commands to the recorder so that a number of parameters may be programmed including: recorder ID, time/date settings, recording rate, alarm levels, and statistics to record. IBM-PC compatible, the support software is supplied on either a 5-1/4 inch double-sided, double density floppy disk or a 3-1/2 inch floppy disk in MS-DOS format. To use the support software, the following equipment is required:

- fBM, AT & T, Compagor other true compatible (consult the factory for a complete list of compatible computers);
- At least 512K of memory;
- One double-sided, double density disk drive (Two preferred);
- A CGA, EGA, or Monochrome graphics card,
- A compatible monitor (CGA, EGA, or Monochrome),

- An optional IBM compatible graphics printer;
- A serial communications port configured as COM 1 or COM 2: and
- An MS-DOS operating system (version 2 11 or later)

Software Main Menu

The DRM Support Software features an easy-to-read main menu that displays a summary of the DRM's status, main menu selections and quick plot graph (see Figure 2).

Recorder Status—The top half of the screen is devoted to a summary of the recorder's status. The unit's clock setting, alarm status, and storage capacity are all displayed along with other pertinent information such as. Line 4 indicates whether the values being saved are minimums, averages or maximums, Line 6 indicates the length of the user-specified recording period in HH/MM/SS format, and Line 7 indicates how much data (in units of time) are stored in the recorder's memory. Note that when the memory is full the Line 7 value remains constant since at the end of each recording period the oldest data is discarded to permit storage of the most recently recorded value.

Main Menu Selections—Main menu selections (F1–F6) are presented in the lower left portion of the screen. Of these, the two functions that will likely be performed the most are: Analyze Recorder Data (F1) which is used mostly for displaying, graphing, and printing recorder data; and Program the Recorder (F2) which is used to program the parameters in the Recorder Status (upper) portion of the menu (i.e. the clock, alarms, recording period, storage capacity etc.). Other main menu selection functions include Process Another Recorder or DTM (F3); Change Baud Rate (F4); and Emulating a Dumb Terminal (F5). A Utilities function (F6) is also included and is used for system configuration or to scale the recorder to the appropriate engineering units

Quick Plot—This portion, which is located on the lower right portion of the screen, is used to provide an unscaled graphic summary of the data contained in the recorder. This can be done without having to perform a detailed analysis of the data (which can be performed using the "Analyze Recorder Data" selection function — F1) The Quick Plot function, therefore, can be used to tell if the attached recorder contains data that is of further interest.

Trademarks: IBM and IBM-PC are trademarks of International Business Machines Corporation MS-DOS is a trademark of Microsoft Inc. AT & T is a trademark or — antic Telephone and Telegraph Inc. Compaq is a trademark of Compaq Computer Corporation.



Specifications-DEM characteristics = Clock Accuracy and the sale (confinued) = conculers/(confinent), cy(rected); corrector ioj svecopodo palgo: Programmable Clock Performance Storeable Values: Storable values Percos any minimum o planting assume out of every strainery capacity 165 P values and pin miniature D sub Respirators (Gener vincilla e la militario del comicila medical concr Luo de Volcada de An aleganies en same inte of establishment of the state o commues recording a replaceable lithium until downloaded Alarm Type: Low power transistor (FFT) switch batteries (SAFT LITHIUM Sample Rate: Samples LS6-BA or equivalent): input once per second transistor (FET) switch Operating Life. At 25°C Recording Interval: Max. Voltage: 30/dc Max. Current: 100mA On/Off Impedance: 15 (77°F), when DRM is used Recording interval can exclusively in data range from once per gathering operating mode, second to once every ohms/1 Megohm, hominal the internal battenes --eight hours; recording Threshold: The points for operate the unit a period selected must be HI and/or LO alarms are minimum of three years; evenly divisible into 24 user-selectable via the Battery Shelf Life: 5 years: hours support software within Storage Capacitor: Allows Sample Accuracy: Battery replacement within entire input range with a Current Input Models. resolution of 8 bits (1 part 60 seconds without loss of ±.004% of span/°C for 0-unit function and 50°C ambient temperature performance **Weight 11 oz. (312 grams) without Backup: When sufficient Voltage input Models: cable; 14 oz. (397 grams) external power is applied 0-15 0-5V: ±.008% of (i e., 9V), the internal with cable span/°C and 0-10: ± 02% batteries are in standby of span/°C for 0-50°C mode On loss of external **Ordering Specifications** ambient temperature power, unit runs on changes internal batteries Resolution: 0.1% (10 Unit DRM Data Recorder En sugar Module **DIN** Aluminum DIN-style Isolation: Output is optoisolated from the case, rail-mount housing input 0-20MA 0-20mA (will withstand up to 35mA inputs without samage). **建筑、海岸上** power, and the input: 500Vac continuous Accessories NOTE: Order as RFI/EMI Protection: Less part ± 0.1% of scale. Crange in an odd to the control of the control o separate items using the SO chie ran se suloni o Odoo en che a no sinote part number (P/N) listed: P/N 800-837-52 Repla ALLISC Contaminor (1) Standard PASS 31 PAL 13-75001-02-PAL 13-75001-02-PERISK - O'BARDE SHALL SHE DOT SO WATE PAL 801-332-26-PAL 801-333-26-PAL 801-333-26-S. L. Barrier B. C. Brancher Operating sange: Action The sales of the sales The state of the s PAREO ESSES Republicados processos Minut RS282 Same na film eller ber egrele de al efer pan: ±2 picter le present di que -Signer Robert Sen explanate Dag filongia interactions (filling and the color, given. zen adjustijen s Mentorcering, specify:

DRM & DTM

Data Recorder Module and Data Transfer Module

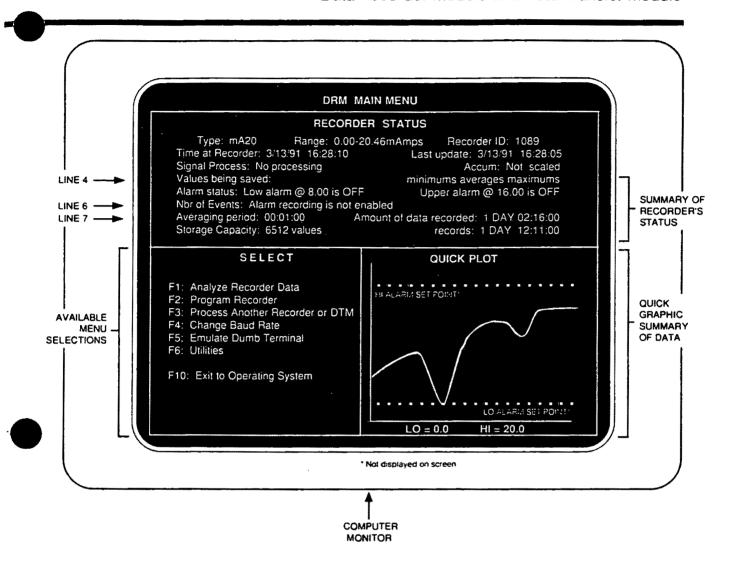
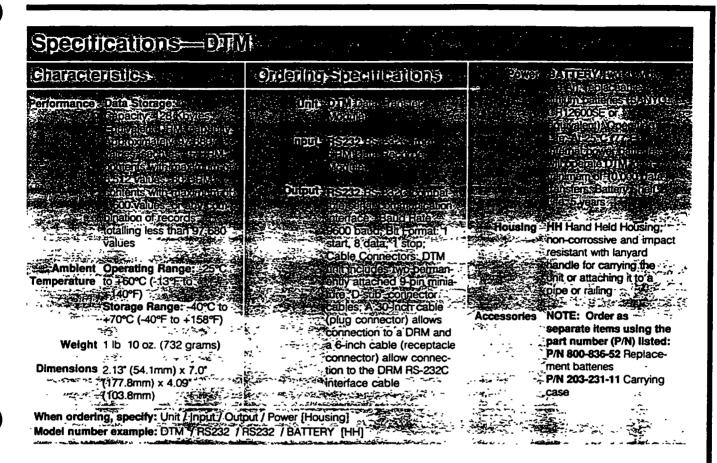


Figure 2. Graphical Presentation of DRM Support Software Screen

DRM & DTM

Data Recorder Module and Data Transfer Module



Data Transfer Module (DTM)

The rugged, hand-held DTM Data Transfer Module (DTM) collects data from up to 15 remotely-located DRM Data Recorder Modules and transfers the data directly into a PC. The DTM allows data to be collected from the DRM without removing the unit from its sampling location.

Two integral cables are provided with the DRM: One is used to connect the DTM to the DRM during data transfer; the other connects the DTM to a cable that connects to the RS-232 port on the host computer for downloading.

Operation—Information is downloaded from the DRM to the DTM by connecting the DTM to the DRM and pushing a button located on top of the DTM. Indication of remaining DTM memory capacity can be determined by pushing the button on top of the unit and viewing the LED also located on the top of the unit's housing. The DTM transfers col-

lected data to the computer using the support software.

Memory—Any combination of process data records totaling up to 120 Kbytes can be stored in a single DTM. This is equivalent to the contents of 15 separate DRM Data Recorder Modules with up to 6,512 values each.

Downloading—When downloading the process data, the host computer can be instructed through the support software to generate separate data files for each individual data set. These data files can then be analyzed at a later time along with any other data files that might have been directly downloaded from any other individual recorders. After downloading, the DTM memory may be cleared using the support software so that it may collect 15 sets of fresh process data.

It is also possible to perform the data transfer from the DRM to the host computer using a modem on each end of the communication line.



United States Telephone: (818) 894-7111 • FAX: (818) 891-2816 Australia Telephone: (02) 525-9177 • FAX: (02) 525-7296

Belgium Telephone: 03/235.35.44 • FAX. 03/271.00.17 Netherlands Telephone: 03440-17971 • FAX: 03440-15920

Singapore Telephone: (65) 7634511 • FAX: (65) 7636176 United Kingdom Telephone: 0293 514488 • FAX. 0293 536852

DRM & DTM

Data Recorder Module and Data Transfer Module

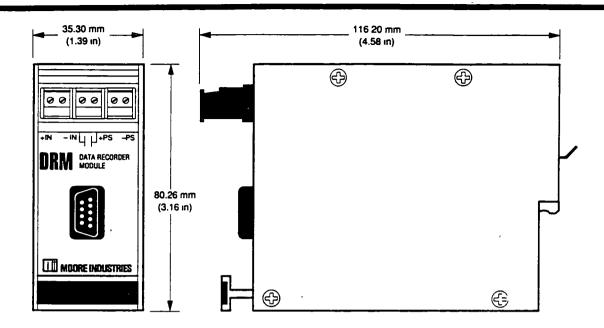


Figure 3. DRM Installation Dimensions

Ordering Information

To construct the correct model number, use the bold face data from the DRM and/or DTM Specification tables listed under "Ordering Specifications" For assistance during this procedure, refer to the model number example presented in the Specification table.

Installation

The DRM's DIN-style housing is designed for high density mounting on a G-type DIN rail Installation dimensions for the DRM are presented in Figure 3 above. Moore Industries also offers a variety of NEMA 4X enclosures for installing the DRM in locations requiring protection from dust, moisture and corrosion.

DRM Signal) SINGULTS	Pin RS232 = 20 Connector	25 Pin RS232 : PC Connector
Dalls Carder Defect			
Secon (Tension)			
Segula to any			
Clear to Send		. Ā	
GND	i en jaron de		

Figure 4. DRM Connector Information

molyant a Charlest Tanks

EQUIPMENT BULLETIN

FLOWSORB



GENERAL DESCRIPTION

Designed for low-flow water treatment applications, prefabricated 55-gallon FlowSorbTM canisters contain all the operating elements found in a full-soale adsorption system. These small, economical treatment systems hold 165 pounds of granular activated carbon for applications including:

- · Small wastewater streams
- Groundwater remediation
- · Underground storage tank leaks
- · Well pump tests
- · Product purification or decolorization
- · Tank cleaning water treatment
- Batch water or product treatment ,
- · Carbon adsorption pilot testing
- · Emergency spill treatment
- · Monitoring well water treatment

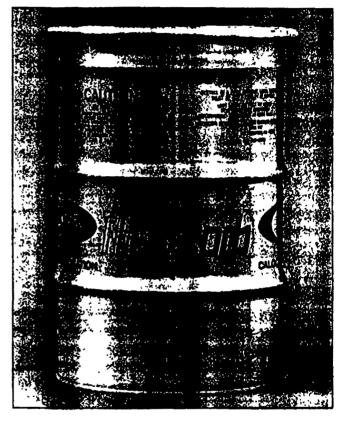
FEATURES

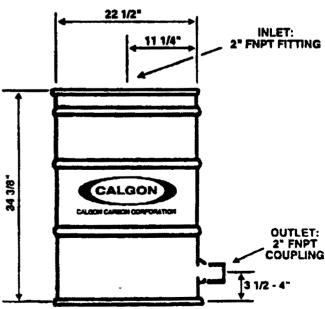
FlowSorb offers several features and benefits to industrial, commercial and municipal users including:

- Sturdy 16 gauge steel construction per DOT specifications
- Continuous treatment at varying flow rates and concentrations
- · Simple installation and operation
- Space above carbon bed facilitates flow distribution or backflushing
- · Flexibility to be used in series or parallel operation
- · Supplied with virgin or reactivated carbon
- · May also be supplied with Klensorb, an oil absorbent media
- Practical disposal option, as pre-approved spent carbon canisters may be returned to Calgon Carbon for safe carbon reactivation
- Low Cost per unit makes carbon treatment economical

FLOWSORB SPECIFICATIONS

Vessel: Open head 16 gauge steel canister
Pressure:15 psig per DOT 17C
Cover: Removable steel cover, 12 gauge bolt ring with
butyi rubber sponge gasket
Internal Coating: Heat cured phenolic epoxy
External Coating: Baked enamel (gray)
Temperature Limit:
380°F (178.7°C) intermittent
Inlet:2" FNPT Nylon fitting
Outlet: 2" FNPT Galvanized steel coupling;
304 stainless steel collector in nylon drum fitting
Carbon: 165 pounds granular activated carbon:
Specify Filtrasorb 300 or reactivated grade
Ship Weight:
Identification: Sequentially numbered for reference





FLOWSORB DIMENSIONS

C-III - 16

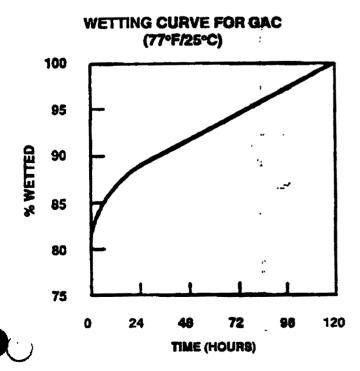
FLOWSORB INSTALLATION

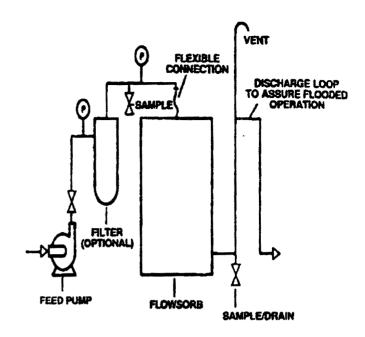
FlowSorb canisters are shipped with dry activated carbon; the carbon must be wetted and deaerated prior to use. This procedure displaces air from the internal structure of the carbon granule, thus assuring that the liquid to be treated is in contact with the carbon surface.

Prior to operation, each canister must be filled with clean water; the water should be introduced into the bottom outlet connection. The unit should set for approximately 48 hours -- this allows most of the carbon's internal bufface to become wetted, as shown on the wetting curve below.

After wetting, the carbon bed can be descrated by draining the canister and again filling the canister upflow with clean water. This procedure will eliminate any air pockets which may have formed between the carbon granules. The FlowSorb is now ready for operation.

Canisters should be set on a flat, level surface and piped as recommended in the installation illustration. The influent pipe in nection should be attached to the unit by using a flexible surface, as some minor deflection of the fld may occur if pressure builds due to filtration or other flow blockage downstream.





TYPICAL FLOWSORB INSTALLATION

FlowSorb discharge piping should include an elevated piping loop to assure that the canister remains flooded with water at all times. In addition to the piping loop, a drain connection is recommended on the discharge piping; this allows drainage of the unit prior to disconnection or temporary shutdown.

A filter should be installed if the liquid to be treated contains substantial amounts of suspended solids. A simple cartridge or screen filter helps prevent pressure buildup in the carbon bed.

FIOWSORB OPERATION

FlowSorb canisters should be full of clean water before treatment begins. Flow rate to the canister should be determined based on required contact time between the liquid and the carbon media. In groundwater treatment applications, the recommended contact time is typically 8-10 minutes with a resultant flow of approximately 5 gpm. Consult your Calgon Carbon Technical Sales Representative for advice about proper contact time for your application.

FlowSorbs can be manifolded in parallel operation for higher flow rates. For series operation, two FlowSorbs can be piped together sequentially, as normal pressure drop will not exceed the recommended operating pressure.

These canisters have space for bed expansion and can be backflushed by introducing clean water or liquid at approximately 20-25 gpm to the cutlet and taking backflush water from the inlet.

If the operating pressure is expected to exceed 5 psig, an application of adhesive caulk at the lid gasket is recommended to prevent leakage. With all surfaces dry, apply the adhesive caulk to the lid recess and lip of the drum per the manufacturer's procedure and set the FlowSorb gasket into the lid recess. After allowing the caulk to set, install the drum lid and tighten the bolt ring.

- *

THEORETICAL FLOWSORB TREATMENT CAPACITY FOR TYPICAL CASES

	Case 1	Case 2	Case 3
Benzene Toluene Xylene	Conc. Gallons 20 ppb 40 ppb 1,600,000	Conc. Gallons 200 ppb 400 ppb 400 ppb	Conc. Gallons 2 ppm 4 ppm 4 ppm
TCE PCE	Conc. Gallons 50 ppb 1,900,000	Case 6 <u>Conc.</u> <u>Gallons</u> 500 ppb } 550,000	Conc. Gallons 5 ppm 4 ppm 3 125,000
Phenoi Total SOC	Case 7 Conc. Gallons 1 ppm } 230,000	Case 8 <u>Conc.</u> <u>Gallons</u> 10 ppm 100 ppm 350,000	Case 9 Conc. Gallons 100 ppm 1,000 ppm 1,000

Each case represents a groundwater or wastewater stream that contains the combination of contaminants listed. The treatment capacity indicates the total gallons of that particular water that may be treated before any of the specific contaminants are present in the treated water as noted. Theoretical capacity based on 5 gpm, water at 70°F or less and 165 pounds of Filtrasorb 300. Background TOC is less than 1 ppm except phenol cases as noted. Contaminants reduced to < 5 ppb, except phenol case which is for 95% phenol reduction.



The treatment table on this page lists the volume of water that can be purified by the FlowSorb for typical contamination situations. However, most applications involve a unique mixture of organic chemical contaminants including some chemicals that adsorb at different capacities or strengths. Please consult with your Calgon Carbon Technical Sales Representative for more information about carbon usage rates.

RETURN OF FLOWSORBS

Arrangements should be made at the time of purchase regarding the future return of canisters containing spent carbon. Calgon Carbon will provide instructions on how to sample the spent carbon and arrange for carbon acceptance testing. The spent carbon is reactivated by Calgon Carbon and all of the contaminants are thermally destroyed. The company will not accept FlowSorbs for landful, incineration or other means of disposal.

FlowSorbs cannot be returned to Calgon Carbon unless the carbon acceptance procedure has been completed, an acceptance number provided, and the return tabels (included with the units at the time of purchase) are attached.

FlowSorbs must be drained — and inlet/outlet connections must be plugged – prior to return to Calgon Carbon.

SAFETY CONSIDERATIONS

It is unlikely that a worker would be able to physically enter a FlowSorb canister. However, the following information and precautions apply to a partially closed canister or altuations where carbon is to be removed from the canister and stored elsewhere.

Wet or dry activated carbon preferentially removes oxygen from air. In closed or partially closed containers, oxygen depiction may reach hazardous levels. If workers must enter a vessel containing carbon, appropriate sampling and work procedures should be followed for potentially low-oxygen spaces – including all applicable federal and state requirements.

CALGON CARBON LIQUID PURIFICATION SYSTEMS

FlowSorb is a unit specifically designed for a variety of small flow applications. Calgon Carbon Corporation offers a wide range of carbon adsorption systems and services for a greater range of flow rates and carbon usages to meet specific applications.

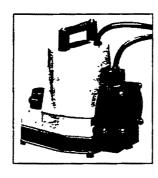












Submersible Utility Dewatering Pumps

- Manual or Automatic
- Up to 1200 GPH

ıd

30 1[]

st st

/le

OB

ıl-

nd

vy 1e

ıd-

on an

ht D,

IP.

10

Ideal for draining flooded areas, rooms, and tanks, plus dewatering of flat roofs. 1/6 HP, 115 Volt 60 Hz. motor. Pumps feature oil-filled aluminum housing with protective coating, viton seal, nylon base and impeller. Can be used with 1" discharge pipe or garden hose. Manual pumps activate when plugged in and pump down to 3/6" or 1/6" with bottom screen removed. Two models, each featuring a piggy-back switch which allows you to use the units manually or automatic. 5-ASP has a ON level at 73/6", OFF level at 3/4". 5-ASP-LL is for low level use and has an ON level at 23/4", OFF level at 1". U.L. Listed and CSA Approved for use with nonflammable liquids compatible with pump materials

PUMP	PER	FORMANCE	GPH @	FEET OF	IEAD
5	10	15	20	22	SHUTOFF
1200	1100	840	520	350	26.3
MODEL	TYPE			STOCK	# EACH
5-MSP-18 5-ASP 5-ASP-LL	AUTO/	AL W/ 18' CORD MANUAL, 10' COF MANUAL, LOW LE		66182 66184 66186	\$66.95 85.95 99.85

Sump Pump Hand Switch

HS-201



Sump Pump Level Switch	
LS-201	

In 20 Sump Pump P-201
Th ho in 1

10

14

garden ers are

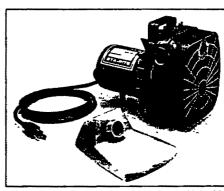
Potent Pumps

- 115 VAC or 12VDC
- · Hose included

Potent Pumps are self priming and are ideal for pumping clear water where a suction lift is desirable. Polypropylene pumping head, Buna N impeller,

polyacetal cam and stainless steel shaft. 3/6" NPT(F) and 3/4" garden hose intake and discharge. Includes two 10' sections of garden hose, with puddle sucker pickup accessory. 115 VAC model has 6 'power cord .12 VDC model has 6' battery cable connector. Non submersible. Intermittent use only (45 min. "on"; 15 min. "off").

MODEL		RFORMANCE GPH EAD @ 10 FT. HEAI	STOCK#	EACH
115 VAC W/ HOSE KIT	275	225	66130	\$ 98.95
12 VDC W/ HOSE KIT	225	175	66132	109.95
12 VDC PUMP ONLY			44906	99.95
12 VDC LIGHTER PLUG			44908	3.95
115 VAC REPAIR KIT			66134	17.95
12 VDC "POTENT PUMP"	REPAIR KIT		66136	17.95
ITT JABSCO "PUPPY PUM		KIT(12 VDC)	44907	27.45





Sta-Rite Puddle Gulper

 Leak clean-up

Capable of removing

water from flat surfaces down to 1/16". 1/2 HP, 115V brush type motor, reinforced PVC body, 3/4 GHT inlet and outlet. Comes with two garden hose adapters, Puddle Gulper attachment, an extra set of brushes, and 8-ft. cord with three pronged grounded plug. Weighs 15 lbs.

PUDDLE GULPER 45865 \$169.00

Hi, I'm Mike. Call me today!

We stock a wide variety of pumps to handle virtually every application. Please call our technical support staff if you need assistance.



Fax 1-708-272-8914



MULTI-PURPOSE VERSATILITY

MultiRanger Plus monitors bulk solids or liquids levels of up to 15 meters (48 feet) in virtually any vessel. This allows you to stock one system for all short to medium range applications.

SELF-ADJUSTING OPERATION

The design of the patented software eliminates the need for operator involvement after the initial calibration. You simply key in the vessel dimensions, display format, and alarm settings. Then, even on applications characterized by dust, turbulence, steam, or agitators, the system is completely self-adjusting because the MultiRanger Plus alters its echo enhancement technique with every momentary variation in bin conditions.

RESOLUTION/ACCURACY/ RELIABILITY

Achievable resolution is 0.1% of range or 2 mm, with accuracy to 0.25% of range or better.

AUTOMATIC VOLUME CALCULATION

Volume conversion of the level information is readily available for eight different vessel configurations. For readout on the four character LCD display, select either a percentage of volume or any standard engineering unit.

VOLUMETRIC FLOW

For applications involving sewage lift stations which require calculation of capacity utilization, the system provides a determination of volumetric flow through the wet well. In any remote location the mA output can indicate well level while the unit displays a local reading, and/or transmits a remote reading, of total volume pumped.

AGITATOR AVOIDANCE

A unique echo processing feature ensures reliable operation and stable readings in applications in which agitators or other stirring devices are used.

C-TII-20

SHORTEST MINIMUM RANGE

LSL-208

To reduce lost tank capacity, the MultiRanger Plus provides an adjustable blanking distance as short as 300 mm (12 inches).

ENVIRONMENTALLY SEALED SYSTEM

After initial installation, the NEMA 4 enclosure need never be opened, eliminating the potential for electric shock hazard, and dust, or water contamination. For easy, safe operation, the magnet backed access programmer slips into the docking bay and communicates with the electronics via a beam of infrared light.

PUMP CONTROL FUNCTIONS

Everything you need for efficient pump control, these functions are geared specifically to those applications with special pump sequencing requirements. Even running time for each pump is automatically totalled, facilitating the scheduling of regular maintenance.

Specifications:

FEATURES

Functions: level, space, differential level, total pumped volume, and open channel flow

Number of Points: one point level measurement, pump control, and open channel measurement; two points for differential level

Number of Relays: 5 form 'C' (SPDT) relays,
250 VAC 5 amps non-inductive;
contacts assignable as alarms,
pump control, sample on time,
or flow, or totalizer

Outputs: milliamp current loop into 350 ohms or 750 ohms, ±0.1% resolution; programmable as either 4-20, or 0-20, or 20-4, or 20-0mA

Alarms: programmable for level, rate of change of level, differential level, exclusive and inclusive band alarm on level, loss of echo and temperature

Display:

units — feet, inches, meters, centimeters and percent of span

messages — loss of echo (LOE) shorted or open cable (CABL LOE)

Fast Alternate Readings in RUN mode with single keystroke

Conversions: eight standard tank shape volume conversions

Programming: parameters entered with removable programmer via the keypad; values protected in E²PROM (no battery back-up required)

Agitator Filter: eliminates echoes from agitator blades

MK2 "Fuzz" Filter: to smooth the small variations in level from surface waves etc.

Transducers: ST25 and ST50 separated from electronic unit by up to 366m (1200 ft)

CHARACTERISTICS

Displays: high contrast 4 character 18mm LCDs 5 LEDs for alarm/pump controls

Resolution: the greater of 0.1% of range or 2mm

Accuracy: to 0.25% or better

Rate Limit: programmable from 0 to 9999 unit(s)/min

Maximum Range: 15 meters (48 ft)

Blanking: near and far blanking; near from 300mm;

far adjustable as a % of span

Temperature: electronics: -20°C to 60°C (-5°F to

140° F), (see transducer spec sheet 550 for process temperature limits)

Power Supply: 100/115/200/230 VAC ± 15% (50/60Hz, 15VA max.)

OPTIONS

12 OR 24-VDC operation, 15 VA max. Air temperature velocity compensation with TS-2 or LTS-1 probe; -40°C to 93°C (-40°F to 200°F) Current loop isolator: LIs-1, 300 VAC isolation

PHYSICAL DESCRIPTION

Polycarbonate EEMAC/NEMA 4, IP65 rated enclosure: $160\times240\times82$ mm ($6.3\times9.5\times3.2$ in)

Weight: 1.8Kg (4lb)

Calibrator: ABS enclosure with polycarbonate membrane keypad; lifetime 9 V lithium battery:

 $102 \times 66 \times 25 \text{mm} (4.0 \times 2.6 \times 1 \text{ in})$

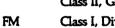
ST SERIES TRANSDUCERS

Milltronics patented non-contacting, ultrasonic transducers are rugged, highly efficient devices. Even in steamy, dusty, corrosive environments they are self-cleaning and maintenance-free. Approved for use in hazardous areas, they can be faced with protective material and flange mounted for corrosive service. Their compact size allows for easy handling and installation.



Approved for hazardous use by:

CSA Class I, Groups A,B,C,D Class II, Groups F & G



Class I, Div I, A,B,C,D Class II, Div I, Groups E,F & G



BASEEFA Class Ex s II T6, Zone 0



SAA Ex s IIB T5

Class I, Zone 0

CENELEC pending

Condensed approvals, consult spec sheet 550.

NO.80

PAGE 3

Jerguson Gage & Valve

TUBULAR GLASS GAGES

Jerguson Gage & Valve offers a complete line of brass, bronze and stainless steel tubular glass gage valves for economical service.

The standard straight-through flow design features a durable cast aluminum wheel. Connections of ½ or ¾ inch NPT are available for attaching the valve to the vessel.

Highly durable Pyrex® gage glass is available with outside diameters of % or % inch. Visibility lengths vary as required. Guard rods or heavy-duty plastic enclosures are recommended to protect the glass from damage, and for added safety.

BRASS GAGE VALVES

Series VA Automatic

Model No. VA-991 %" Dia. Glass, ½" NPT Vessel Conn. Model No. VA-902 %" Dia. Glass, %" NPT Vessel Conn.

These tubular glass gage valves feature brass body construction. They come complete with corrosion-resistant ball checks for automatic closure in the event of glass breakage. This ensures safety and prevents the loss of fluid. Maximum working pressure is 200 psi @ 400°F, or 400 psi @ 100°F.

NOTE: Pressure ratings will vary depending upon temperature and glass length. Refer to table for complete ratings.

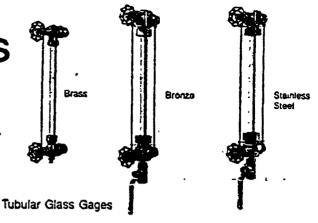
Series VB Non-Automatic

Model No. VB-991 %" Dia. Glass, %" NPT Vessel Conn. Model No. VB-902 %" Dia. Glass, %" NPT Vessel Conn.

These all brass valves are similar to above models. However, ball checks are not standard, thus making operation non-automatic. A %"-inch needle drain valve in the lower unit accommodates a breakage condition. Either a %"-inch lower arm ball valve or a petcock is available upon request. Sizes, packing materials and working pressures are identical to above models.

Length Diamoter (in) 100°F 400°F 100°F 400°F 100°F 400°F										
						316 Stainless Senes VF & VG				
		100°F	400°F	100°F	400°F	100°F	400°F			
		Max P\$1	Max PSI	Max PSI	Max PSI	Max PSI	Max PSI			
	%	400	200	420	250	420	315			
10	. %	400	500	410	250	Senes 1 100°F Max PSI 420	310			
	14	400	200	410	250	410	305			
12	*	400	200	400	250	400	300			
	3/6	360	200	360	250	360	280			
18	3/4	355	200	355	250	355	275			
	36	350	200	350	250	350	270			
20	*	345	200	345	250	345	265			
	1/4	320	200	320	250	320	255			
24	*	315	200	315	250	315	250			
	*	280	•	280	•	280	•			
30	*4	275	•	275	٠	275	•			
	44	245	•	245	•	245	•			
36	₹4	240	•	240	•	240	·			
	3%	230	•	230	•	230	•			
40	*	225	•	255	•	225	·			
	3/4	195	٠	195	. •	195	•			
48	*	190	•	190	•	190	•			
	%	150	•	150	•	150	٠			
60	½	145	-	145	•	145	•			
	14	100	•	100	-	100	-			
72	¥.	100	•	100	·	100	•			

*Not Recommended



BRONZE GAGE VALVES

Series VC Automatic

Model No. VC-991 %"Dia. Glass, %" NPT Vessel Conn. Model No. VC-902 %" Dia. Glass, %" NPT Vessel Conn.

Conforming to A.S.M.E. power-boiler code requirements, these gage valves feature stainless steel ball checks in both upper and lower units. This provides automatic closure in the event of glass breakage and requires the ball check in the lower valve to rise vertically to its seat. A safety handle is also provided for manual operation of the *%*-inch diameter drain valve. This valve is of the full-flow ball valve design.

The valve body is constructed of rugged, heavy pattern bronze. Standard packing materials are wear-resistant Teflon®-asbestos. Maximum working pressure is rated at 500 psi @ 100°F, or 250 psi @ 400°F.

NOTE: Pressure ratings will vary depending on temperature and glass length. Refer to table for complete ratings.

Series VE Non-Automatic

Model No. VE-991 %" Dia. Glass, 1/2" NPT Vessel Conn. Model No. VE-902 1/4" Dia. Glass, 1/4" NPT Vessel Conn.

These gage valves are identical in every respect to above models, except for the non-automatic design. Ball checks are not included.

NOTE: Plastic protector enclosures are not available for the above glass gages.

STAINLESS STEEL GAGE VALVES

Series VF Automatic

Model No. VF-891 %" Dia. Glass, %" NPT Vessel Conn. Model No. VF-802 %" Dia. Glass, %" NPT Vessel Conn.

These stainless steel gage valves are ideally suited for handling alcohol solvents, acetic acid, keytones and numerous other corrosive fluids.

These valves have been designed in accordance with the A.S.M.E. power boiler code standards. They require ball checks in both upper and lower arms for automatic closure should glass breakage occur, with the ball check in the lower valve rising vertically to its seat. A 1/16-inch diameter drain valve of full-flow ball valve design, operated by a manual safety handle, is standard. Maximum working pressure is 500 psi @ 450°F.

NOTE: Pressure ratings will vary depending on temperature and glass length. Refer to table for complete ratings.

Series VG Non-Automatic *

Model No. VG-891 %" Dia. Glass, 1/2" NPT Vessel Conn. Model No. VG-802 1/4" Dia. Glass, 1/4" NPT Vessel Conrr.

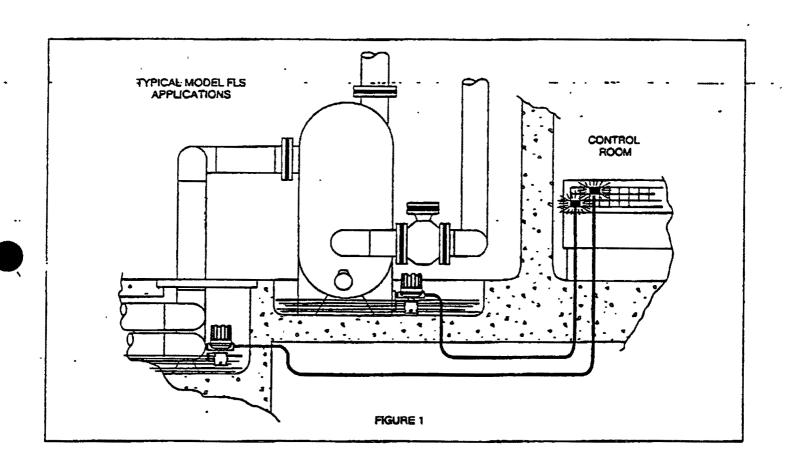
Same as allowe models but without ball checks. Its operation is therefore classified as non-automatic.

NOTE: Plastic protector enclosures ar glass gages.



Model FLS
Flood Level Switch
Descriptive Data





DESCRIPTION

The Model FLS P/N 53-4701-001 is a float operated liquid level control designed for bracket mounting in floor level sumps or troughs. The proven Magnetrol magnetic coupling is employed to transmit float movement to a single snap action dry contact switch mechanism. The switch is factory set for ¾ level differential for off-on control — alarm and/or safety shut-down service.

APPLICATIONS

The Model FLS is used to detect leaks or spills from critical valves, vessels and pipe lines in power plant installations, as shown in Figure 1.

16 Flood Level Switch LSH-202

The level and flow specialist

CONSTRUCTION

Simple and rugged in design, the Model FLS is constructed of quality materials throughout to assure reliable operation and a long trouble-free service life.

FLOAT ENVELOPE

A perforated stainless steel float envelope is welded to a forged steel bracket assembly totally enclosing the float and providing a side mounting surface. A stainless steel bottom strap, tack welded to the float envelope, acts as a low level float stop.

FLOAT AND TRIM

300 series stainless steel float with a 400 series magnetic attraction sleeve. Internal trim is 300 series stainless steel.

SWITCH MECHANISM

The Magnetrol series 8 switch mechanism with SPDT contacts is standard and rated:

15 A resistive & 3.8 A inductive @ 120 VAC 0.50 A resistive & 0.05 A inductive @ 120 VDC 180°F maximum ambient temperature

SWITCH HOUSING

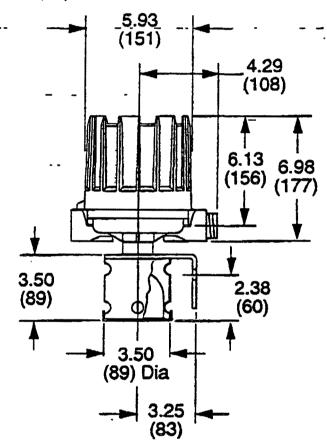
A NEMA 4X,6,7/9 cast Iron submersible electrical enclosure is standard, and allows 180° positioning of the conduit outlet for wiring convenience.

AVAILABLE OPTION

Qualified to IEEE 323-1974, and IEEE 344-1975.

ij

DIMENSIONAL SPECIFICATIONS inches (mm)



STI Controls, L.P.

\$300 Belmont Road + Downers Grove, Illinois 60\$15-4499 + 708-969-4028 + Pax 708-080-9489

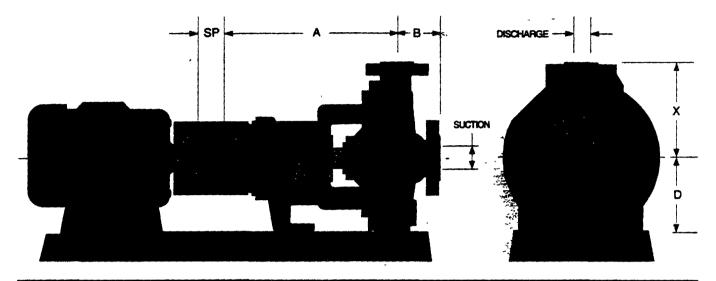


\$300 Scimont Road • Downers Grove, ittinoiz 60515-4488 • 706-963-4000 • Fax 708-965-9489 6291 Dormen Road • Misaissauga, Ontano LAV-IN2 • 905-478-2720 • Fax 905-678-7407 Helisenssraut 6 • 8 9240 Zeie, Seighun • 962-45.11.11 • Telez 25944 • Fax 052-45.09.93 Ragent Business Ctr., Jublios Rd. • Burgess Hill, Sussex RH15 9TL U.K. ex 01444-871313 • Fax 01444-871217 BULLETIN: 44-306.5 EFFECTIVE: October 1995 SUPERSEDES: March 1994



DITION Model LF 3196

All dimensions in inches and (mm). Not to be used for construction.



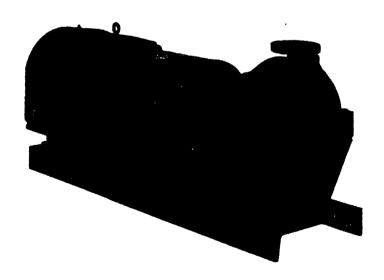


High Temperature LF 3196

For high temperature services (500°-700°F/260°-370°C), the LF 3196 is furnished with the following standard features:

- Centerline-mounted casing
 Graphite casing gasket
 Graphite impeller O-ring
 Jacketed stuffing box
 High temperature bolting
 Stainless steel shaft
 Finned oil cooler

いたことのは

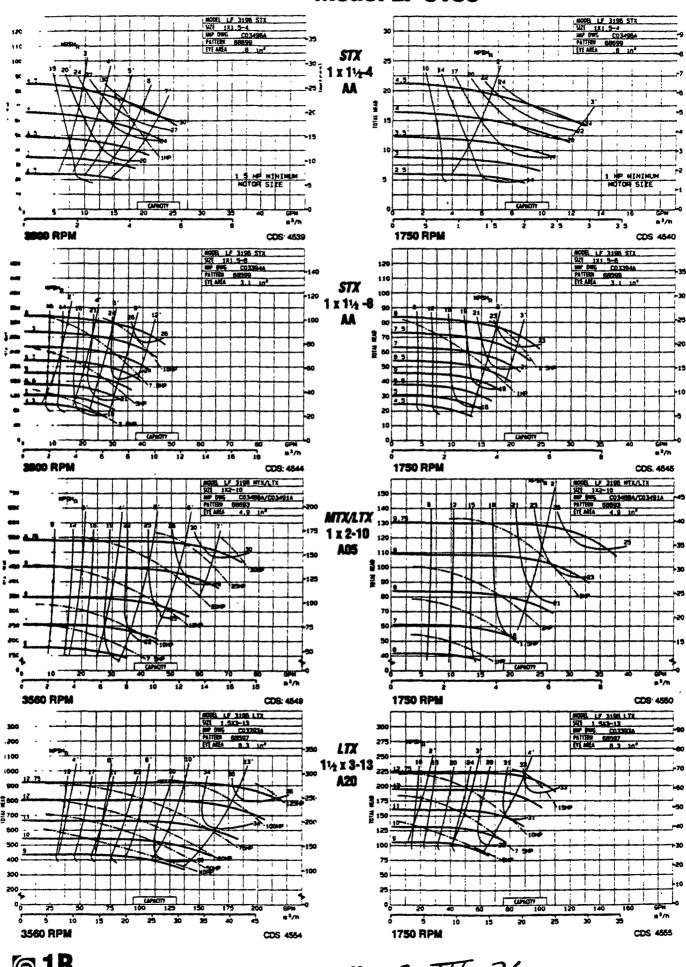


Carbon Adsorber Feed 21 Pump

P-202

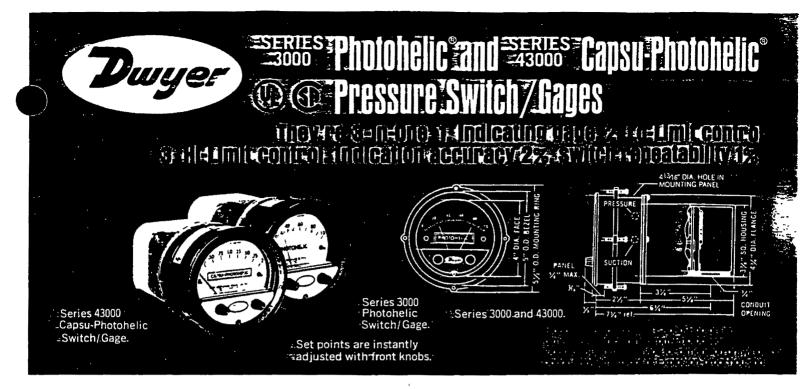
C-III-25

© 1B



1B

C-III-26



Both Photohelic[®] and Capsu-Photohelic[®] Switch/Gages function as versatile, highly repeatable pressure switches combined with a precise pressure gage employing the time-proven Magnehelic[®] design. The lower cost Photohelic measures and controls positive, negative or differential pressures of air and compatible gases. Standard models are rated to 25 psig with options to 35 or 80 psig. Single pressure 36000S models measure to 6000 psig with a 9000 psig rating. The Capsu-Photohelic employs an encapsulated sensing element for use with both liquids and gases at pressures to 500 psig. Optional cast brass case is available for water or water based liquids.

Two phototransistor actuated. DPDT relays are included for low/high limit control. Easy to adjust setpoint indicators are controlled by knobs located on gage face. Individual setpoint deadband is one pointer width – less than 1% of full scale. Setpoints can be interlocked to provide variable deadband – ideal for control of fans, dampers, pumps, etc. Gage reading is continuous and unaffected by switch operation, even during loss of electrical power. Choose from full scale pressure ranges from a low 0-.25" w.c. up to 300 psi; single positive pressure to 6000 psig.

PHOTOHELIC SENSING - HOW IT WORKS

In typical applications, these Dwyer switch/gages control between high and low pressure set points. When pressure changes, reaching either set point pressure, the infrared light to the limiting phototransistor is cut off by the helix-driven light shutter. The resulting phototransistor signal is electronically amplified to actuate its DPDT slave relay and switching occurs. Dead band between make and break is 1% of full scale or less – just enough to assure positive, chatter-free operation.

RELAY-TRANSFORMER FEATURES

A translucent Styrene Acrylonitrile housing protects all electronic components. Solid-state and integrated circuit electronics are on glass-epoxy printed circuit boards and self-extinguishing terminal boards.

APPLICATIONS - PHOTOHELIC SWITCH/GAGES

In both series of pressure switch/gages, you get the convenience of a visual indication plus high-low limit switching. For both OEM and in-plant applications, the Photohelic switch/gage is used to control pressures in air conditioning systems, clean rooms, fluidic and pneumatic control systems, materials handling equipment; alarm or control fume exhaust systems; control pressure in air structures and monitor respiratory and blood pressures

PHYSICAL DATA

Ambient Temperature: 20 to 120°F (-6.7 to 49°C) Low temperature option available

Rated Pressure: Photohelic, -20" Hg. to 25 psig (-67 to 1.7 bar). MP option, 35 psig (2 4 bar), HP option; 80 psig (5 5 bar). 36003S-36010S, 150 psig (10.3 bar). 36020S and higher; 1.5 × full scale pressure Capsu-Photohelic, -20" Hg. to 500 psig (-67 to 34 4 bar).

Accuracy: Photohetic, ±2% of full scale at 70°F (21.1°C) 3% on -0 and 4% on -00 models. Capsu-Photohetic, ±3% of full scale at 70°F (21.1°C). 2% on 43000S models; 4% on 43215, 43220 and 43500.

Gage Connections: Photohelic, 1/8" NPTF Capsu-Photohelic, 1/4" NPTF

Power Required: 120 VAC 50/60 Hz

Electrical Rating of Relays: 10A @ 120 VAC, 6A @ 240 VAC, 60 Hz res.

Conduit Opening: 3/4" conduit

Finish: Baked, dark gray hammerloid.

Weight: Photohelic, 4 lbs. (1.8 kg) Use with air or compatible gases only Capsu-Photohelic, 5 lbs., 12 oz. (2.6 kg) Use with air or compatible gases or liquids Brass case required for water or water based bounds.

STANDARD MODEL

Two phototransistor-actuated circuits and two DPDT relays permit both high and low alarms or limit controls. Relays are de-energized when gage pointer is to the left of respective set points; relays are energized as pointer passes to the right of set points. Loss of electrical power or loss of pressure provide "fail safe" protection.

OPTIONS

Single contact, right set point, for actuation on increasing or decreasing pressure.

OEM Model, less relay and transformer components and housing but including phototransistor(s), light shutter and set pointer(s). For single or double contact.

Remote-Mounted Relay, relay pack may be mounted remotely from gage. Specify cable length required.

Tamper-proof knobs, low temperature option, special scales, voltages and other features and modifications are available.

Special Housings available include Weatherproof (NEMA 4X) and Explosion-proof (NEMA 7 & 9; NEC C1 I, Gr C&D, C1 II, Gr E, F&G; C1 III). Contact Customer Service for detailed dimension drawings.

HIGH AND LO¹ 22
Dwyer Photohe low-latching c the equipment v and until manua plications wher switch/gage or o tions are include button such as I

Cartridge Filter High Differential Pressure PDISH-203

Carbon Adsorber High Differential Pressure PISH-204, 205, 206 th-latching, ruits. That is, nce activated nd signal apr Photohelic ional instrucy circuit push

Straightforward design assures maintenance-free performance

Bezel provides flange for flush mounting in panel.

"O" ring seal for cover assures dust tight integrity of case.

Clear plastic front cover is highly resistant to breakage. Provides undistorted viewing of pointer and scale.

Precision scale, litho-printed on aluminum, is accurate and easy to read.

Red tipped pointer of heat treated aluminum tubing is easy to see. It is rigidly mounted on helix shaft.

Pointer stops of molded rubber prevent pointer over-travel without damage.

Samarium cobalt magnet mounted at end of range spring rotates helix without mechanical linkages.

"Wishbone" assembly provides mounting for helix, helix bearings and pointer shaft."

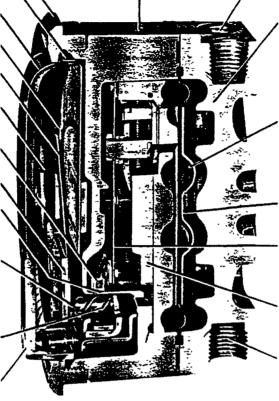
Thin wall magnetic "window" is well braced and of minimum area for maximum pressure capability.

Sapphire bearings for helix are shockresistant mounted. They provide virtually friction-free rotation for helix. Rotation is damped with high viscosity silicone fluid.

Helix is precision milled from an alloy of high magnetic permeability, deburred and annealed in a hydrogen atmosphere for best magnetic qualities. Mounted in sapphire bearings, helix rotates to align with magnetic field of magnet and transmit pressure indication to pointer.

Zero adjustment screw is conveniently located in plastic cover, accessible without removing cover. "O" ring seal provides dust seal.

Range spring calibration is screw adjusted. Rate adjust and rate adjust lock are coaxial and are factory set and sealed.



nt Nos. 4.011.759 4,030,365

Top low pressure connection (for Air or Gas) connects to chamber in back of diaphragm. High pressure air or gas port (cut away; not shown) connects with chamber in front of diaphragm through passageways in case.

Precision made case is offered in two materials. Standard is die cast aluminum coated inside for resistance to most oils and similar fluids. Optional forged brass case is recommended when using water or water based liquids. One case size for all pressure ranges - can be either surface or flush mounted.

Silicone rubber diaphragm with integrally molded "O" ring is sealed between the case and backplate. Diaphragm motion is restricted to prevent damage due to over-pressure. Double convolution allows choice of effective areas to suit range at time of assembly.

Diaphragm support plate of stainless steel minimizes position or attitude sensitivity.

Calibrated range spring is a flat leaf of stainless steel. Small amplitude of motion assures consistency and long life. It reacts to pressure on diaphragm. Live length factory adjusted for calibration.

Range spring mounting plate provides mounting for rate adjust screw and for the calibration range spring and magnet assembly.

Bottom high pressure connection (for Liquids) connects to chamber in front of diaphragm. Low pressure liquid connection (not visible) connects with chamber in back of diaphragm through passageways in case.

			SERIES Scales rea	4000 1102 i	Gyrann in 160 Gyrann in 160	हि = त भावाय	OD USE	LS AND R	ANGE availa	S ile:			
			Aumber of Water		inger Joeda		1007	Model ac	Range, CM of Water		ing. Omgi	236	
Section 1	663555	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	4302 88 103 1 103	D=8=+	Hone zanto Hone hinte Hone hinte Hone hinter		於	\$000 15CM \$000 20CM \$000 25CM \$000 10CM	0.15 0.02 0.02 0.03 0.03 0.03 0.03 0.03 0.03	300	0002	125 120 120 120 120 120 120 120 120 120 120	
•	25.50 3.50 3.50 3.50 3.50 3.50 3.50 3.50		Total Lings		्रिस्ट्रास्ट्रिक्ट विद्यास्ट्रिक्ट्रिक्ट्र	off);[au	180	OUT OF THE COMMENT OF	6 100 6 150 6 200 6 250 6 300	7.5万万万	ANGERES		
13			700 700 710 710 720 220		Maraka and Maraka Maraka Maraka	FINGS	o (fili Gréss progr	AND ACTUAL TO STATE OF THE STAT	(e) (dec (e) (dec (e) (dec			# 1	श्रेष्ट्र मुळ
-	5.95454		7405 2805 2805 21005 22005		edanie Mange enfilie eksternie eksternie eksternie eksternie	421-312	从数据书	Special	Purposi ges			64 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	eace.
A TOTAL	0:0) (m60)	Open Tipe	Suggested Special Suggested Special Sp	100	tile bita janiining () Karen baba mada	લાઈ પ્રાત્સ દેવાં દ્વીયાં છે. હેલ્દ સાથે દ્વા	25.25	Jelie N Saturije Sogality	o. 2401 Root Range		Other Car		
	5 6 5 5 7 (valin) (o	in prass case only	dial you son with the state of	SUHEL 30000)		28	76-1	aniks Secily	Cale Range				

Check these features for dependable control

Bezel and front cover with set point knobs and zero adjustment screw removed to expose Photohelic® set point mechanism. Cover is clear polycarbonate plastic.

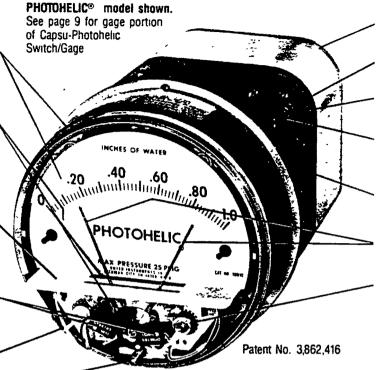
Gage pointer and light shutter are mounted on helix and balancing counterweight. Shutter passes through slot in optical limit switch to expose phototransistors to integral infrared light source or mask them depending on applied pressure.

Light shield effectively protects phototransistors from strong outside light sources yet allows free pointer movement. It also gives interior a neat "finished" look.

Optical limit switches are used for reliability and long service life. Attached directly to set pointers, they are individually aligned to assure precise switching accuracy.

Flexible drive shaft connects to set point knobs.

Zero adjustment screw connects to screw in cover.



Styrene acrylonitrile enclosure protects electronic components and electrical connections.

Polycarbonate connection or terminal board is self-extinguishing

Glass-epoxy printed circuit boards best for durability and permanence.

Load relays are D.P., DT with latching feature for maximum application versatility.

Electronics are designed to operate on 50/60 Hz, 110 volt current with 10% over or under voltage Special units for other voltages are available.

Switch set pointers show switch settings at all times

Spring loaded friction clutch prevents operator damage of set point mechanism.

MODELS AND RANGES - SERIES 3000 PHOTOHELIC® AND SERIES 43000 CAPSU-PHOTOHELIC® SWITCH/GAGES

NOTE: Model numbers below indicate the Series 3000 Photohelic[®] Switch/Gage (except for figures in white).

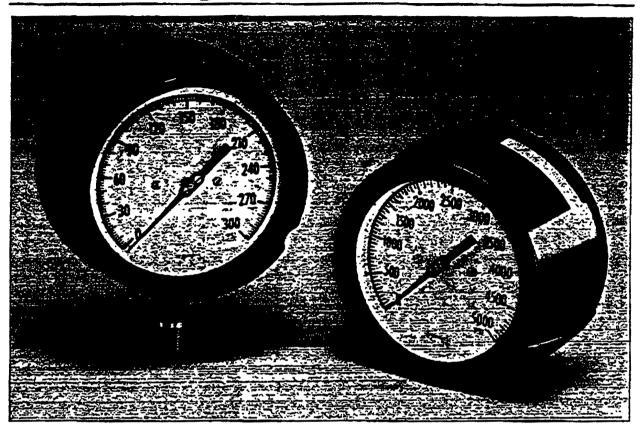
IMPORTANT! When ordering Capsu-Photohelic® models, refer to Range table below, BUT instead of first digit Model Number "3", use number "43", for example: 43000-0 rather than 3000-0. Also specify desired range.

Almost any standard requirement can be met by one of the models shown in tables below. Page 5 also shows examples of special Photohelic models built to OEM customers' specifications. Special scales can be furnished in ounces per square inch, inches of mercury, metric units, etc. For details, contact the factory.

Model Inc Number of W	es Minor		Range PSI	Minor Div. — PSI	Model Number	Range, MM of a Water	Minor Div.	Model Number	Range, Pascals	Minor Div.	Special Purpose
3000-0 -3001 2 0 1 3002 3 0 2	25 005 50 01 0.7 002 0.8 005	3201 9202 3203 3204 3204	0-1 0-2 30-3	025000	3000-6MM 3000-10MM 28000-25MM 3000-50MM		5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	*3000-60Pa 3000-125Pa 3000-250Pa 3000-500Pa	0-60 0-125 0-250 -0-500	20 50 50 100	Scale No. 11) Scale No. 11) Scale No. 10)
3003 20-3 3004 8 3 3 8005 8 3	0	9210 2215 2270 2201	0-10: 0-15	50	3000-100MM	100 T	2.0 🛎	3000-750Pa	#0-750 iter Ranges	25.0	
3006 3008 3010 3010	10 20 20	230 Action	0-30-5 r standard r standard	010	3300-20MM	40D-10		*3300-250Pa * 23300-500Pa *	125-0-125 250-0-250	3.0 10.0	
3015 3020 3025			ក្នុងច្នាស់ច្នាចា	only	The officer	fabre, E	Minor -	Model Number	erkange, Kilopascals	I MIDST I	
3030 53 408 3040 50 50 3050 50 50		43240S 4 43260S 4 43280S =	0.40 0.60	10 20 370	Number 3000-15CM 3000-20CM	Dater Dater		3000-1kPa 3000-1.5kPa 3000-2kPa	1015 1015	第02章 第05章 第05章	I VIONO CONTRACTOR CONTRACTOR
3060 3080 3100		432100S- 432200S 432300S25	0=100=		3000-25CM 3000-50CM 3000-80CM			3000-3kPa 3000-4kPa 3000-5kPa	0-3 0-4	100	Tribud State of Con-
3150 20 20 20 20 20 20 20 20 20 20 20 20 20	0黎為70多	143600452 14360065-2 143601053	0400%	€ 10 0 ∴ 20 0 c ,	\$000-100CM \$000-150CM \$000-200CM	50 F0 S	全 () 2.0美	3000-8kPa 3000-10kPa 2000-15kPa	0.10	20	SERIODIS TO IL SANCE- ZIERON AND THE CORPT- TICE OF THE TEXT OF THE SERIODISTA
	00₹ 5.0 00\$ 10.0 00\$ 10.0	†436020S	0-2000 0-4000	50.0 • 100.0 • 200.0	3000-250CM 3000-300CM	150,250	10.0	3000-2010-3 3000-2510-3 3000-3010-3	20 a	100	Macon Market Trans.
45500 205	00≨ 10.0	September 50	ale Air Veloc Lise with pitot i	ity Units	3300-4CM	420-23E	建0 多	Signotzero Cer		1.0/4E	TOTALESS (Of Modivalents) The provided for Europe (1) The provided for
*3300-0 3251	25 201	\$6000-00AV	025	Velocity FPM	3300-10CM 3300-30CM	180025		3300-1169a 38300-3169a	450-35 45-0-15	₹103 1103	cale in a vertical posi- tion
3301 3302 3304 3310	5 20	3000-0AV 3001AV 3002AV	7~0-2.0 ' l	500-2800 ÷ 500-4000 ± 1000-5600 *	pressure and swit	on switches a	hall incorpo	wate gages and switz se diaphreum operate	d with switching	accompli	or continuous indication of applied ished by photogramsistor controlled
3320 3330 15-0		These n	andele auaile	2000-12500 ible only	retays. Set point a Photohetic or C	edjustment sh epsu-Photohe	all be controlled Cetals	odled by knobs on frog No.	ont of unit. Swi	nch/Gages mer colum	a shall be Dayer Instruments, Inc. In, in

Process Gauges

Series 1500



The Acragage® 1500 Series process gauges are extremely rugged, accurate, and are designed to meet the most precise requirements of the process industry.

Specifications

DIAL SIZE: 4.5°

*CASE: Phenolic.

WINDOW: Double strength glass standard,

acrylic or shatter proof glass

available.

RING: Polypropylene.

DIAL: White coated aluminum with

black markings.

POINTER: Micrometer adjustable, black

coated aluminum.

MOVEMENT: 300 Series stainless steel, or brass

completely adjustable.

BOURDON TUBE: Phosphor bronze or SS.

SOCKET: Brass, carbon steel or SS.

CONNECTIONS: 1/2" NPT LM or LBM standard,

1/4" NPT and special connections available.

ACCURACY: ± 0.5% FS (Grade 2A).

RANGES: See Table VII.

OPTIONS: This gauge is liquid fillable

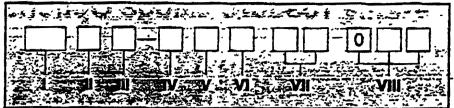
Refer to last page for Model Selection Chart.

23 Adsorber Pump Pressure Gauge PI-210

24 Effluent Pressure Gauge

PI-211

Model Selection Chart



Not all combinations are possible - Please consult factory. Other options are possible.

Table I-Series	Table V-Connection	•
01-100 Series -	1-1/8" LM	BB-0-8,000 PSI
02-200 Series	2-1/8" CBM	BC-0-10,000 PSI
03-300 Series	3-1/4" LM	BD-0-15,000 PSI
04-400 Series	5-1/4° LBM	· BE-0-20,000 PSI
05-500 Series	6-1/2" LM	GA-60" H ₂ O-0 VAC
06-600 Series	7-1/2" LBM	GB-50" H ₂ O-0 VAC
07-700 Series	8-1/4" Autoclave LM	GC-40" H ₂ O-0 VAC
10-1000 Series	9-1/4" Autoclave LBM	GD-30" H ₂ O-0 VAC
15-1500 Series	0- 30612 Pi Socket	GE-20" H ₂ O-0 VAC
16-1600 Series		GF-10" H ₂ O-0 VAC
17-1700 Series -		GG-10-0-10" H ₂ O
18-1800 Series	Table VI-FIII Fluids	GH-15-0-15" H ₂ O
19-1900 Series	1-Dry	GI-20-0-20° H ₂ O
20-2000 Series	2-Glycenn	GJ-30-0-30" H₂O
	3-Silicone DC-200	GK-40-0-40" H₂O
	4-Mineral Oil	GL-50-0-50" H ₂ O
Table II-Dial Size	5-Fluorolube	GM-0-10° H ₂ O
1-1.5"		GN-0-15" H ₂ O
2-2.0		GO-0-20" H ₂ O
3-2.5	Table VII-Ranges &	GP-0-30° H ₂ O
5-3.5 *	Scales	GQ-0-40" H₂O
6-4.0°	AA-30"Hg VAC-0	GR-0-60" H ₂ O
7-4.5°	AB-30-0-15 PSI	GS-0-80" H ₂ O
8-6.0 "	AC-30-0-30 PSI	GT-0-100° H ₂ O _
	AD-30-0-60 PSI	GU-0-160" H ₂ O
•	AE-30-0-100 PSI	GV-0-200" H ₂ O
Table III-Tube/Socket	AF-30-0-150 PSI	GW-0-300° H ₂ O
1-Phosphor Bronze / Brass	AG-30-0-200 PSI	GX-0-1 PSI
2-316SS / Carbon Steel	AH-30-0-250 PSI	GY-0-2 PSI
_ 3-316 SS / 316 SS	. Al-30-0-300 PSI	- GZ-0-3 PSI -
4-Monel / Monel	AJ-0-15 PSI	HA-0-5 PSI
5-SS Bellows / SS	AK-0-30 PSI	HB-0-10 PSI
6-Brass Bellows / Brass	AL-0-60 PSI	HD-50-50" H ₂ O
	AM-0-100 PSI	HF _t 0-50" H ₂ O
	AN-0-160PSI	H0-0-150" H ₂ O

Table IV-Case A-Plastic, A.B.S., or Equal

B-Steel

C-Stainless Steel **D-Phenolic**

F-Aluminum Flangeless I-Stainless Front Flange J-Aluminum Front Flange-Hinged Ring

P-SS U-Clamp R-Aluminum Front

Flange-Threaded Ring

AO-0-200 PSI AP-0-300 PSI

-AQ-0-400 PSI AR-0-500 PSI AS-0-600 PSI AT-0-800 PSI AU-0-1,000 PSI AV-0-1,500 PSI AW-0-2,000 PSI

AX-0-3,000 PSI AY-0-4,000 PSI

AZ-0-5,000 PSI BA-0-6,000 PSI HU-0-8 PSI IC-3-15/0-150 PSI

ID-0:2,500 PSI IF-3-15/0-300 PSI IG-3-15/0-1,500 PSI IH-3-15/0-5,000 PSI II-3-15/0-500 PSI IK-0-3000 PSI/7600 RAM IM-0-7,500 PSI

IQ-3-15/0-1200 PSI IU-3-15/0-2000 PSI IV-3-15/0-3000 PSI IY-0-100 PSI/0-230 ft H2O

APPENDIX C

CATALOG CUTS

SECTION IV

UNNUMBERED TREATMENT PLANT EQUIPMENT



95 Series: Pressure: Regulators

Fisher Controls

November 1979

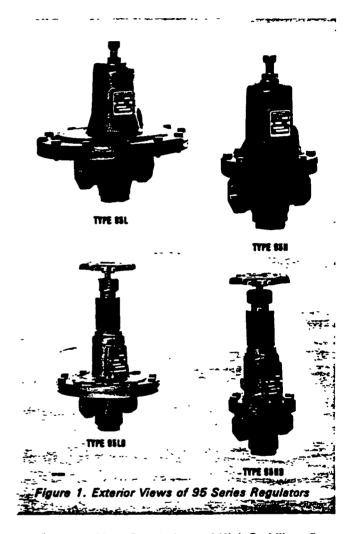
Bulletin 71.1:95

The Fisher 95 Series regulators (see figures 1 and 2) are compact, small-size, large-capacity, self-operated pressure regulators. They are available in 1/8-inch through 2-inch sizes, and in four different configurations.

These general-purpose regulators are suitable for steam, air, gas, oil, water, and other fluids. They may be used on any application requiring accurate pressure or differential pressure control. The Types 95L and 95H regulators use spring force acting on the diaphragm to regulate the outlet pressure. The Types 95LD and 95HD regulators use spring force to maintain a pressure differential between the spring case loading pressure and the regulator outlet pressure (see figure 3). Spring case loading pressure may be applied from another pressure system or a manual loading regulator. Specific applications include their use on test fixtures, wash tanks, sterilizers, steam tables, fuel lines, plant air supplies, and oil seals on centrifugal pumps or turbines. The small sizes of the regulators make them particularly adaptable to installations having space limitations.

Features

- Excellent Fluid Compatibility—The body is available in stainless steel as well as in cast iron and cast steel.
- Tight Shutoff and High Capacity—A flat-faced seat construction provides better shutoff than the conventional bevel-seal construction. The composition diaphragm and seat provide tight shutoff below 150°F (66°C), while the metal seating surfaces used for higher temperatures are carefully machine-lapped to ensure shutoff.
- Easy Maintenance—When servicing or repair is necessary, 95 Series regulators need not be removed from lines for maintenance and repair. Valve guiding and seating parts are accessible by removing valve plug guides on the bottom of the units.



- Smooth, Close Regulation and High Stability—Regulator design isolates the diaphragm and pressure response chamber from the main flow stream through the regulator.
- Easily Adjustable Differential Pressures—The Types 95LD and 95HD regulators have handwheels on top for easy pressure adjustments.
- 1 Carbon Adsorber Inlet Pressure Regulator
- 3 Carbon Adsorber Outlet Pressure Regulator

Specifications

AVAILABLE CONFIGURATIONS

Type 95L: Low-pressure regulator for 2 to 30 psig (0.1 to 2.0 bar)

outlet pressures

Type 95H: High-pressure regulator for 15 to 150 psig (1.0 to 10.3 bar)

outlet pressures

Type 95LD: Low-pressure differential regulator for 2 to 30 psi (0.1 to 2.0 bar) differential pressures Type 95HD: High-pressure differential regulator for 15 to 150 psi (1.0 to 10.3 bar) differential

. .

pressures

BODY AND PORT SIZES

Types 95L, 95LD, 95H, 95HD 1/8-inch and 1/4-inch bodies: 1/4-inch

(6.4 mm) port

3/8-inch and 1/2-inch bodies: 3/8-inch

(9.5 mm) port

3/4-inch and 1-inch bodies: 9/16-inch

(14.3 mm) port

Types 95H and 95HD: 1-1/4 inch, 1-1/2 inch and 2-inch bodies with

1-1/16 inch (27.0 mm) port

END CONNECTION STYLE

NPT screwed pipe threads

MAXIMUM PRESSURES See table 1 **AND TEMPERATURES**

REDUCED OUTLET PRESSURE AND **OIFFERENTIAL** PRESSURE RANGES See table 2

PRESSURE SETTING ADJUSTMENT

Types 95L and 95H: Adjusting screw for adjustment throughout the pressure setting range of the spring.

Types 95LD and 95HD: Handwheel for adjustment throughout the pressure setting range of the spring.

PRESSURE REGISTRATION

Types 95L and 95H: Internal Types 95LD and 95HD: Internal combined with outside pressure source for differential pressure

PRESSURE CONNECTIONS

See figure 5 _ f i-sate =

CONSTRUCTION MATERIALS

See table 3

MATERIAL TEMPERATURE CAPABILITIES

Maximums: See table 1

Minimums: -20°F (-28.9°C) for all standard construction materials; consult your Fisher representative about minimums for specific mater-

ial combinations

TYPICAL REGULATING CAPACITIES

Air: See tables 5, 6, and 7 Steam: See tables 8, 9, and 10 Water: See tables 11, 12, and 13

FLOW **COEFFICIENTS** See table 4

APPROXIMATE WEIGHT

Types 95H and 95HD 1/4-inch body: 4 lb (1.8 kg)

3/8 and 1/2-inch bodies: 8 lb (3.6 kg) 3/4 and 1 inch bodies: 20 lb (9.1 kg) 1-1/4, 1-1/2, and 2-inch bodies: 73 lb

(33.1 kg)

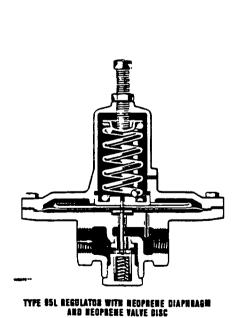
Types 95L and 95LD 1/4-inch body: 6 lb (2.7 kg)

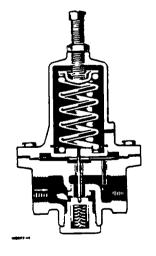
3/8 and 1/2-inch bodies: 12 lb (5.4 kg) 3/4 end 1-inch bodies: 32 lb (14.5 kg)

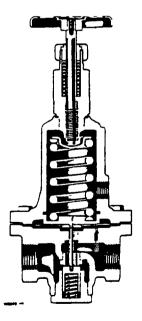
Table 1. Maximum Pressures and Temperatures

REGULATOR TYPE	BODY AND DIAPHRAGE SPRING CASE AND SEAT		AT PRESSURE		MAXIMUM OUTLET PRESSURE*		MAXIMUM TEMPERATURE		MAXIMUM SPRING CASE PRESSURE			
	MATERIALS	MATERIALS	Paig	Bar	Psig	Bar	°F	°C	Paig	Bar		
	Cast Iron	Composition All-Metal	250 250	17.2 17.2	30 30	2.0 2.0	150 410	66 210				
95L	Cast Steel or Stainless Steel	Composition All-Metal	300 300	20.7 20.7	30 30	2.0 2.0	150 450	66 232		plicable		
	Cast Iron	Composition All-Metal	250 250	17.2 17.2	150 150	10.3 10.3	150 410	66 210	(Spring Case Is Vented)			
95H	Cast Steel or Stainless Steel	Composition All-Metal	300 300	20.7 20.7	150 150	10.3 10.3	150 450	66 232				
251.5	Cast Iron	Composition All-Metal	250 250	17.2 17.2	50 50	3.5 3.5	150 410	66 210	50 50	3.5 3.5		
95LD	Cast Steel or Stainless Steel	Composition All-Metal	300 300	20.7 20.7	125 125	8.6 8.6	150 450	66 232	125 125	8 6 8.6		
	Cast Iron	Composition All-Metal	250 250	17.2 17.2	250 250	17.2 17.2	150 410	66 210	250 250	17.2 17.2		
95HD	Cast Steel or Stainless Steel	Composition Ali-Metal	300 300	20.7 20.7	300 300	20.7 20.7	150 450	66 232	300 300	20.7 20.7		

^{*}For Types 95LD and 95HD regulators, the outlet pressure equals the spring case loading pressure plus the spring setting







TYPE OSM REGULATOR WITH METAL DIAPHRAGM AND METAL SEATING SURFACES

TYPE 95HD REGULATOR WITH METAL DIAPHRAGM AND SEAT, ALSO TYPICAL OF TYPE 95LD

Figure 2. Sectional Views

C- IV-4

Table 2. Spring Part Numbers for 95 Series Body Sizes and Pressure Ranges

TYPE BODY SIZE, NUMBER INCHES		DIFFE	LET OR RENTIAL SSURE NGE"	SPRING PART NUMBER AND COLOR		
		Psig	Ber	7		
	1/8, 1/4	2 to 6 5 to 25 13 to 30†	0.1 to 0.4 0.3 to 1.7 0.9 to 2.0†	1E3925 27022 Yellow 1E3926 27012 Green 1E3927 27142 Red		
95L and 95LD	3/8. 1/2	2 to 8 5 to 25 13 to 30†	0.1 to 0.4 0.3 to 1.7 0.9 to 2.0†	1E3956 27022 Yellow 1D7455 27142 Green 1E3957 27192 Red		
	3/4, 1	2 to 6 5 to 25 13 to 30†	0.1 to 0.4 0.3 to 1.7 0.9 to 2.0†	1E3989 27022 Yellow 1E3990 27142 Green 1E3991 27162 Red		
	1/8, 1/4	15 to 30† 25 to 75 70 to 150	1.0 to 2.0† 1.7 to 5.2 4.8 to 10.3	1E3925 27022 Yellow 1E3926 27012 Green 1E3927 27142 Red		
_95H	3/8/1/2	15 to 30† 25 to 75 70 to 150	1.0 to 2.0† 1.7 to 5.2 4.8 to 10.3	1E3956 27012 Yellow 1D7455 27142 Green 1E3957 27192 Red		
and	3/4, 1	15 to 30† 25 to 75 70 to 150	1.0 to 2.0† 1.7 to 5.2 4.8 to 10.3	1E3989 27022 Yellow 1E3990 27142 Green 1E3991 27162 Red		
	1-1/4, 1-1/2, 2	5 to 80 60 to 120 100 to 140 120 to 150	0.3 to 5.5 4.1 to 8.3 6.9 to 9.7 5.5 to 10.3	1E7953 27082 Light Blue 1E7954 27082 Light Gray 1E7933 27082 Yellow 1D7888 27082 Black		

^{*}Pressure ranges given for Types 95L and 96H regulators indicate actual outlet pressure For Types 95LD and 95HD regulators, the pressure renges indicate the differential pressure that can be obtained with the indicated againg The differential pressure (spring

setting) is added to the spring case loading pressure to determine the actual outlet pressure. Type 95H is recommended where close regulation is not required Type 95L is recommended where close regulation is required.

ς, **ύ**

Tam 3A -

Table 3. Construction Materials

Trim No.	Diaphragm	Seat Ring	Valve Plug	Valve Disc Holder	Valve Disc	Valve Plug Guide	Materials Common to All Regulator Types
1 1 2 1	302 SST Neoprene	416 SST Brass	416 SST	Bress	Neoprene	Brass Brass	
3A ^{2,3} 4A ^{2,3} 5 6A	Neoprene 302 SST Neoprene Neoprene	416 SST 416 SST 416 SST 416 SST	416 SST 416 SST	416 SST 416 SST	Neoprene Neoprene	416 SST 416 SST Bress Bress	Valve Body: Cast iron, Steel, or SST
7A ³ 8 ^{2.3} 9 ³ 10 ^{2.3}	302 SST Neoprene 302 SST Neoprene	416 SST 416 SST 316 SST Brass	416 SST 316 SST	416 SST	Neoprene Neoprene	416 SST 416 SST 316 SST 416 SST	Spring Case: Cest Iron or Steel Valve Stem: 416 SST
11 ³ 12 ³ 13 14 ³	302 SST 302 SST 302 SST Neoprene	416 SST 316 SST Brass Hast C ⁴	Hast C	416 SST 316 SST Brees	TFE TFE TFE	416 SST 316 SST Brass Hast C	Regulator Spring: Cadmium-Plated Steel Spring Wire Valve Plug or Disc Holder Spring: 302 SST
15 16 ³ 17 ³	Neoprene Neoprene Neoprene	316 SST 416 SST 316 SST	Brass 	416 SST 316 SST	TFE TFE	316 SST 416 SST 316 SST	Packing (Types 95LD and 95HD only): Spring-loaded TFE
20 24 ³ 37 ³ 39 ³	Neoprene Neoprene R Monei ⁵ Neoprene	Brass Hast B K Monel Hast C	K Monei	Brass Hast B Hast C	TFE TFE TFE	Brass Hast B R Monei Hast C	-

Standard trim for all body materials
 Standard trim for cast steel and stainless steel bodies.
 No brass parts

⁴ Trademark of Statista Division Cabot Corp 5 Trademark of International Nickel Co

98 Series Relief and Differential Relief Valves

Fisher Controls

June 1977

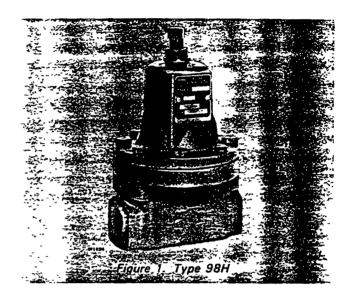
Bulletin 71.4:98

The 98 Series is used for back pressure or relief applications in liquid, gas, air, and steam service. The Types 98L, 98H, and 98HH are self-operated and spring-loaded, while the Types 98LD, 98HD, and 98HHD use additional pressure loading to maintain relief or differential relief pressure settings.

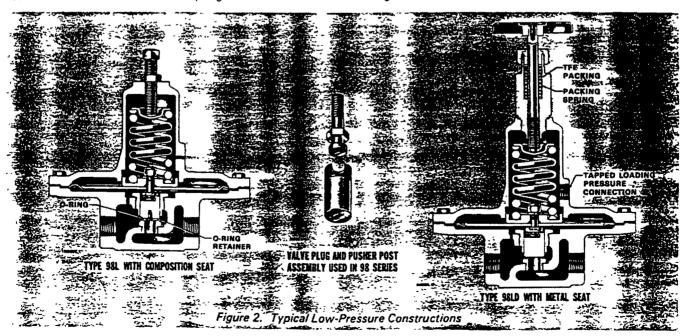
Features

- Versatility—Typical applications include use in wash tanks, small space heaters, fuel and oil lines, air supply systems, test fixtures, and sterilizers.
- Excellent Fluid Compatibility—Diaphragms come in stainless steel or elastomers, and body and spring case are available in stainless steel as well as cast iron and steel. Corrosion-resistant trims are available.
- Close, Stable Regulation—Diaphragm is isolated from the main flow stream. Slotted valve plug and pusher post assembly (figure 2) provides positive guiding for improved shutoff.
- Compact Design—Small sizes allow easy installation in limited spaces.
- Differential Pressure Capability— Spring-loaded TFE packing and tapped connections permit pressure loading of Type 98LD, 98HD, and 98HHD spring cases.

2



 Adjustment Capability—Positive settings of the Types 98L, 98H, and 98HH are afforded by the locknut that firmly secures the adjusting screw. Handwheels (standard on the Types 98LD, 98HD, and 98HHD, and optional on some sizes of the Types 98L and 98H) allow easy pressure setting changes.



Carbon Adsorber Inlet Pressure Relief Valve

Specifications

AVAILABLE
CONSTRUCTIONS

Types 98L, 98H, 98HH: Selfoperated with standard adjusting screw

Types 98LD, 98HD, and 98HHD: Pressure-loaded with handwheel adjustment

BODY AND PORT SIZES

- NOMINAL BODY	SIZE (INCHES)	PORT DIAMETER		
Types 98H & 98HD	"All Other Types	(INCHES)		
3/8, 1/2	· 1/4 ·	1/4		
3/8, 1/2	3/8,1/2	3/8		
3/4,1 法国	變3/4,1	9/16		
1-1/4, 1-1/2, 2	Not available	1-1/16		

END CONNECTION STYLE

NPT screwed

CONSTRUCTION MATERIALS

Body and Spring Case: Cast iron,

steel, or stainless steel

Spring: Steel

Trim and Diaphragm: See table 1

MAXIMUM INLET PRESSURES, PSIG'

	STEEL (WCB)	CAST IRON BODY				
NUMBER	OR SST BODY	MS TO All Trims Metal Trims		Trims'		
	Fisoety A	160°F	To 315°F	To 406°F		
98LD 3	12 H 25 M	60 U	<u></u>	60		
98H	- 100 - 100	00				
	200	400				
-		200		different parties		

RANGES

ALLOWABLE TEMPERATURE Nitrile Parts: -20°F to 200°F Neoprene Parts: -40°F to 150°F Viton® Parts: 0°F to 250°F Metal Diaphragm and Seat Cast Iron Body and Spring Case: -100°F to 406°F Steel Body and Spring Case:

€20°F to 450°F

Stainless Steel Body and Spring Case: =320°F to 450°F

RELIEF PRESSURE RANGES See table 2 The second secon

MAXIMUM SPRING CASE LOADING PRESSURES, PSIG (TYPES 98LD, 98HD, AND 98HHD ONLY)6

				# 725 mm.70 //
	STEEL (WCB) OR	CASTIR	ON SPRIN	G CASE
TYPE	SST SPRING CASE	All Trims	Metal	Trims4
NUMBER	(ALL TRIMS TO 150°F)	To 150°F	To 315°F	To 406°F
98LD	125	50	50	60
98HD	300	250	_ 250	235
- 98HHD	250	` 250	150	100

CAPACITIES"

Types 98L and 98LD: See tables

Types 98H and 98HD: See tables

Types 98HH and 98HHD: See

Tables 13-17

Handwheel or tee Types 98L and 98H.

Exampled spring case vent for types (BLand 98H).

Feat washeld opermit spring (BS) and (BS) and (BS) are spring (BS) and (BS). 6616

Table 1. Trim Materials

	Mary Minnes	MAT	ERIAL	The state of the s
	Composition Seat	THE PERSON NAMED IN	Metal Seet 3	
	(Standard)	Trim 4 (Standard)	Times nove	Time:
Seat Ring O-Ring Seat O-Ring Retainer Valve Plus	710 SST 316 SST 210 SST 316 SST 710 SST 316 SST	Not used 18 SST, hardened 18	Notused Notused	Insulate Insulate Victor
Valve Plug Guide Diaphragm Pusher Post Diaphragm Retaining Washer	Neoprene Viton 16 SST 316 SST 316 SST 316 SST 316 SST	416 SST Neoprene 416 SST 416 SST Not used 302 SST 302 SST	316.SST 418.SST 302.SST 416.SST 416.SST 416.SST 302.SST 302.SST 3	Intelloress 302 Street III polecio Hamilore Notused 4

Table 9. Water Relief Capacities in Gallons per Minute, Types 98H and 98HD with Metal Diaphragm

NOMINAL	SPRII	NG	RELIEF PRESSURE	FLOW AT		PR	ESSUF	RE BUI	LDUP	OVER R	ELIEF S	ETTING	, PSIG	
BODY SIZE,	Part Number	Color Code	SETTING, PSIG	SETTING, GPM	5	7	10	15	20	30	40	50	75	100
	1E3925 27022	Yellow	15 25 35	1 8 1 8 1 8	2 9 3 4 4 6	3 4 3 8 4 4	4 46 52	4 9 5 5 6 2	6 2 7	8 4				
1/4	1E3926 27012	Green	35 50 75	1 5 1 5 1 5	2 2 2 8 3 4	3 5 3 6 4 5	3 7 4 6 5 8	4 8 5 2 6	5 8 6 8 8 4	7 2 8 9 8	9 2 10 9	10.7 11 8	129	
1/4	1E3927 27142	Red	75 100 125	1 3 1.3 1.3	17 2 22	2 23 26	2.5 2 9 3 2	3 3 3 8 4 4	4 43 48	5.6 6.6 7.4	7 8.2 9 5	8 2 9 4 11	10 7 11 8 13 2	136 15
	1L3461 27142	Blue	150 175 200	1 1 1	18 2 22	2 2 2 4 2 7	2 8 3 3.4	3.7 4 2 4 8	4 7 5.2 5 9	6 6 7 2 8	8 2 9 2 10 2	9 6 10 8 11 8	12 3 13 6 15	14 2 15 6 16 9
	1E3956 27022	Yellow	15 25 35	1 8 1 8 1 8	3 5 6	45 65 92	6.7 8 9 5	7 7 10 12	11.7 14	16.5				
,	107455 27142	Green	35 50 75	1 5 1 5 1 5	3 37 42	3 7 4 5 5 5	4 7 5 7 7 2	6 75 105	75 9 13	10 12 17	1 4 5 19	16.5 21	24 5	-
3/8, 1/2	1E3957 27192	Red	75 100 125	13 13 13.	2 7 3 4 2	35 4 55	45 52 7	6 5 7 5 9 5	8 9.7 12	11 5 13.7 16.5	14 5 17 20	17 19.5 22.5	21 7 24 5 28	28 31
	1L3800 27142	Blue	150 175 200	1 1 1	3 32 33	3.7 42 43	4 7 5 5 5 6	6.5 7.5 8	8 5 9.5 10 2	11 5 13.5 15	14 7 17 2 19	17 5 20.5 22.2	24 28 29 5	29 33 2 35
	1E3989 27022	Yellow	15 25 35	1 8 1 8 1 8	6 13 16	13 16 19	16 19 5 23	20 24 28	 32 33	37				
	1E3990 27142	Green	35 50 75	1 5 1.5 1 5	8 11 14	14 15 20	16.5 18.5 26	21 24 33	23 28.5 37	29.5 35.5 42.5	40 47	44 50	58	!
3/4, 1	1E3991 27162	Red	75 100 125	1 3 1.3 1.3	7 9 11	10 12 14.5	14 18 20	20 25.5 30	26 32 38	35 41 50	41.5 49 56	46 54 60.5	55 62 67 5	6 8 72
	1L3801 27232	Blue	150 175 200	1 1 1	7 8 9	9 10 12	12 14 17	17.5 20.5 24.5	23 27 32.5	34 39 47	43 50 58	51 59 66	66 74 79	76 81 85
	1E7923 27092	Dark Gray	5 10 15 25 35	3.6 3.6 3.6 3.6 3.6	18 20 23 26 29	23 27 30 34 37	35 39 43 46 50	60 65 70	75 B2			•••	· ·· ·· · ·	
1-1/4, 1-1/2, 2	1E7953 27082	Light 8lue	25 35 50 75	3 3 3 3	17 20 24 30	24 27 30 35	36 40 43 46	48 52 57 63	65 70 76 80	80 90 100	98 112	105 125		
	1E7954 27082	Light Gray	50 75 100	2.5 2.5 2.5	14 17 20	23 26 30	34 37 40	47 53 58	65 70 76	85 92 102	96 108 122	110 125 140	150 165	178
	1 P7888 2 7082	8lack	75 100 125 170	2.3 2.3 2.3 2.3	8 10 13 16	13 16 18 20	23 26 29 32	33 37 42 46	50 56 60 63	65 72 80 85	81 89 98 105	95 105 114 120	130 140 150 165	165 180 195

TYPE 95L REGULATOR

Body Size, Inches	-	١			C		D		
	ln.	mm	in.	mm	łn.	mm	in.	mm	
1/8, 1/4	2.25	57	1.81	46	4.56	116	5.06	129	
3/8, 1/2	3.88	99	1.81	46	6.12	155	7.00	178	
3/4, 1	4.88	124	2.25	57	9.12	232	10.19	259	

TYP	E 9	5H F	REGI	ULA	TOR

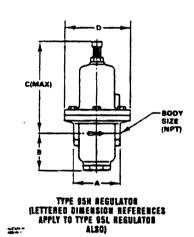
1/8, 1/4	2.25	57	1.81	46	4.50	114	3.19	81
3/8, 1/2	3.88	99	1.81	46	6.00	152	4.25	108
3/4, 1	4.88	124	2.25	57	9.00	229	6.06	154
1-1/4 1-1/2 2	7 25	194	2 56	85	14 44	267	9 10	208

TYPE 95LD REGULATOR

Body Size,	A		В		С		D		E (NPT)	J	
Inches	in.	mm	ln.	mm	in.	mm	in.	mm	In.	in.	mm
1/8, 1/4	2.25	57	1.81	46	7.94	202	5.06	129	1/8	2.75	70
3/8, 1/2	3.88	99	1.81	46	10.12	257	7.00	178	1/4	4.00	102
3/4, 1	4.88	124	2.25	57	15.31	389	10.19	259	1/2	4.00	102

TYPE 95HD REGULATOR

1/8, 1/4												
3/8, 1/2	3.88	99	1.81	46	10.00	254	4.25	108	1/4	4.00	102	
3/4, 1	4.88	124	2.25	57	15.12	384	6.06	154	1/2	4.00	102	
1-1/4, 1-1/2, 2	7.25	184	2.69	65	18.31	465	8.19	208	1/4	6.75	171	



C(MAX)

BODY
SIZE
(NPT)

TYPE 95HD REGULATOR

TYPE 95HD REGULATOR (LETTERED DIMENSION REFERENCES APPLY TO TYPE 95LD REGULATOR ALSO)

Figure 5. Dimensions

Ordering Information

When ordering, specify:

Application Information

- 1. Type of gas being controlled (air, ammonia, etc.); list any factors such as impurities in the gas that may affect the compatibility of the gas with the regulator trim parts
- 2. Specific gravity of the gas
- 3. Temperature of the gas
- 4. Range of flowing inlet pressure to regulator

- 5. Outlet pressure setting or range
- 6. Flow rates
 - a. Minimum controlled flow
 - b. Normal flow
 - c. Maximum flow

Regulator Information

Refer to the specifications on page 2 and carefully review the description to the right of each specification and specify your choice whenever a selection is offered. Always specify the type number as identified in the specifications.

While this information is presented in good faith and believed to be accurate. Fisher Controls does not guarantee satisfactory results from reliance upon such information. Nothing contained herein is to be construed as a warranty or guarantee, express or implied, regarding the performance.

merchantability, litness or any other matter with respect to the products, nor as a recommendation to use any product or process in conflict with any patent. Fisher Controls reserves the right, without notice to after or improve the designs or specifications of the products described herein.

FISHER'

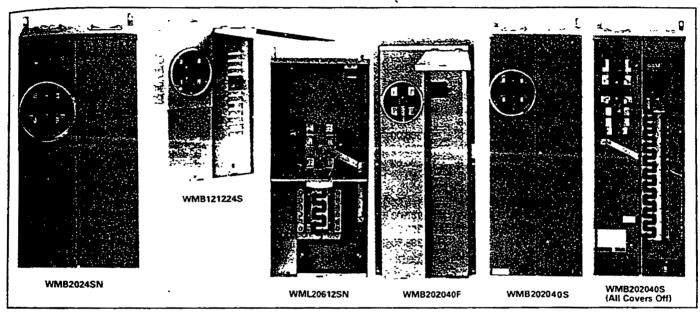
Fisher Controls

For information write
P.O. Box 190, Marshalltown, lowa 50158, U.S.A.
or Brenchley House, Maidstone, Kent ME 14, 1UQ, England



Electrical Distribution Equipment Residential Meter Breaker Panels Westinghouse

Meter Breaker Panels



Single Phase, 3 Wire—120/240 Volts AC—10,000 AIC NEMA 3R, Rainproof, with RH Hub Provisions—Overhead or Underground Service

	Main .	•	Branch C Breaker Pro			Mfr.	Mfr.	Line
,	Ampere	Max.	1-Pole	Max. 2	2-Pole	Catalog No.	Catalog No.	Wire
	Rating	1" CB	1/2" C/B	1" C/B	1/2" C/B	Semi-Flush	Surface /	Range
Mai	n Breaker Fa	ctory Instal	led				*	
	100	12	24	6	10	WMB101224F	WMB101224S	#14-1/0 Cu/AI
<u> </u>	125	12	24	6	10	WMB121224F	WMB121224S	#14-1/0 Cu/A!
y	200	20	40	10	20	WMB202040F	WMB202040S	#6-250 MCM Cu/Al
-	200	4	8	2 15	4	Schler	WM82048SLB_	#6-250 MCM Cu/AL
	200	32	40	15	20		WMB203240S	#6-250 MCM Cu/AI
	225	20	40	15	20	WMB222040F ^Ø	WMB222040S [©]	#6-300 MCM Cu/Ai
Ord	er Main Brea	ker Separa	tely					
	100	····	· -	1	_		WMB102RN@3	#14-1/0 Cu/Al
	125	4		2	2	WMB1224FN	WMB1224SN	#14-1/0 Cu/Al
355	125	4		Ž	2		WMB1224SCN [©]	#14-1/0 Cu/Al
	125	4		2			WMB1224SCR®®	#14-1/0 Cu/Al
	200 (Space Pro	ovisions®)				WMB20FN®	WMB20SN®	#6-250 MCM Cu/AI
140	200	4		2	2	WMB2024FN	WMB2024SN	#6-250 MCM Cu/AI
	200 (Space Pro	ovisions®)					WMB20SRO®	#6-250 MCM Cu/AI
	200	4		2	2		WMB2024SR [®]	#6-250 MCM Cu/Al
	200	4	8	2	4		WMB2048SLR®	#6-250 MCM Cu/Al
	200	20	40	10	20		WMB202040R ^{©®}	#6-250 MCM Cu/AI
Mai	n Lug Only						•	
	200	12		6	*****	_	WML20612SN®	#6-250 MCM Cu/Al
ന ം		· •		•				

[®]Single cover Florida design

Accessories

Mfr. Catalog No.

WMB5J 5th Jaw Assembly Barrel Lock Kit Barrel Lock Kit WMB-LK-1 WMB-LK-2 WMB-LK-3 Barrel Lock Kit

Order BR, BRH main tenant breakers Order WFP, WFPH main tenant breakers

If separate Ground Bus is required order WMB24GB, WMB9GB

Electrical Panel

C- IV-10

o'clock position - 1-21 in enclosure 2-27 in enclosure 3-36 in enclosure

(continued on next page)

[©]Overhead Feed Only

©Compact design Does not maet EUSERC requirements

[®]Provisions for 1 WFP/QFP breaker to 200A Does not meet EUSERC requirements

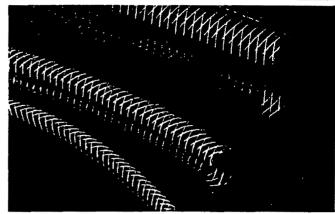
[©]Underground Feed Only **DAvailability to be announced

BRAIDED POLYURETHANE HOSE



- · Withstands oil, grease, fuels and many chemicals.
- Abrasion-resistant.
- · Low-temperature flexibility.
- · Contains no plasticizers.
- · Resistant to weather, ozone, and radiation.
- Smooth inner and outer surfaces.

Now you can employ the combination of superior abrasion resistance and higher working pressures, with Ryan Herco's braided polyurethane hose. It's not only far stronger than unreinforced tubing; it is an ether-based, not ester-based, urethane, providing superior resistance to moisture and fungus. Its incredible low-temperature flexibility outperforms braid-reinforced vinyls as well. Because of the dual extrusion, barbed insert fittings (not compression type) are recommended.



ORDER: 0580-(Size No.) BRAIDED POLYURETHANE HOSE, 100 ft. coils

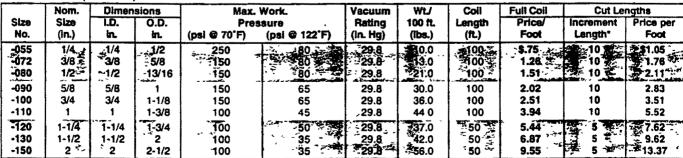
	Nom.	Dimensio	ns	Max. Work.	Wt./	Full Coil	Cut Le	ngths
Size No.	Size (in.)	I.D. in. (mm)	O.D. in.	Pressure (psi @ 70°F)	100 ft. (lbs.)	Price/ Foot	Increment Length*	Price per Foot
-055	1/4	1/4 (6.35)	.472	250	9.0	\$1.87	10	- \$2.62
-072	3/8	3/8 (9.53)	.630	190	12.0	2.66	10	3.72
-080	1/2	1/2 (12.7)	.748	150	15.0	3.37	10	- 4.72
-090	5/8	5/8 (15.9)	.906	130	20.0	4.59	10	6.43
-100	3/4	3/4 (19.1)	1.024	100	23.0	5.21	10	7.29
-110	1	1 (25.4)	1.300	80	47.0	7.59	10	10.63
-120	1-1/4	1-1/4 (31.8)	1.710	75	52.0	13.58	2.75	19.01
-130	1-1/2	1-1/2 (38.1)	1.929	50	72.0	14.83	5 3	20.76
-150	2	2 (50.8)	2.519	· '340	₫:100.0	36.80	* £5 <i>*</i>	÷ 51.52

*Smallest cut increment available for a given tubing size.



- Spiral steel wire reinforcement incorporated within the walls of flexible PVC tubing.
- Made from non-toxic ingredients conforming to FDA standards. NSF approved for potable water.
- . Kink- and crush-resistant.
- Handles both positive and negative pressures.
- The glass-like clarity on the mirror-smooth surface provides outstanding visual flow characteristics.
- · Lightweight, yet tough and abrasion-resistant.
- · Full vacuum transfer hose.

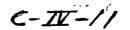
ORDER: 0518-(Size No.) WIRE-REINFORCED PVC TUBING



*Smallest cut increment available for a given tubing size 1/4" - 1" tubing, 100 ft coils. 1-1/4" - 2" tubing, 50 ft. coils



5 Hose

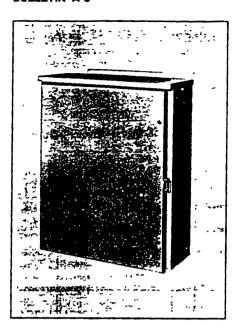




। सार (अब प्राचीकार प्राप्ता है । इस (अवह ए OME) । वर्षा (**अस्ति** सार अस्ति ।

BULLETIN A-3





APPLICATION

Designed for use as wring boxes and junction boxes. Provide protection in outdoor installations against rain, sleet and snow, or indoors against dripping water.

CONSTRUCTION

- 16 gauge or 14 gauge G-90 grade galvanized steel
- Drip shield top and seamfree sides, front, and back protect from rain, snow, or sleet
- 16 gauge galvanized steel continuous hinge has stainless steel pin
- Cover tastened securely with captive plated steel screws
- Hasp and staple provided for padiocking
- · No gasketing or knockouts
- Collar studs provided for mounting optional panel

FINISH

Dark gray enamel inside and out over galvanized steel. Optional panels are white enamel.

INDUSTRY STANDARDS

NEMA Type 3R UL 50 Type 3R CSA Enclosure 3 (See table) IEC 529, IP32

ACCESSORIES	Page
Corrosion Inhibitors	366
Electric Heaters	364
Panel Support Krt	376
Panels (See table) 3	
Rack Mounting Angle Kit	387
Swing-Out Panel Kit	378
Terminal Kit Assemblies	380
Window Kit	
Wiring Duct	

REFERENCES age Chemical Resistance Chart Guide to Materials and Finishes Industry Standards Modifications Price List

Table J.14

Enclosure

STANDARD SIZES

	Enclosure Catalog Number	Gauge	Enclosure Size AxBxC	"Panel Catalog Number	Panel Size DxE	Mounting GxH	Overali L	Body Opening SxT	Center Stiffener	P	j	K
	‡ A-16R126HCR	16	16.00x12.00x6.00 (406x305x152)	A-16P12	13.00x9.00 (330x229)	17.00x5.00 (432x127)	18.00 (457)	13.88x9.25 (353x235)	Not included	-	3.50 (89)	-
	‡ A-16R166HCR	16	16.00x16.00x6.00 (406x406x152)	A-16P16	13.00x13.00 (330x330)	17.00x9.00 (432x229)	18.00 (457)	13.88x13.25 (353x337)	Not included	_	3.50 (89)	-
	; A-20R166HCR	16	20.00x16.00x6.00 (508x406x152)	A-20P16	17.00x13.00 (432x330)	21 00x9 00 (533x229)	22.00 (5 59)	17.88x13.25 (454x337)	Not Included	-	3.50 (89)	-
	‡ A-20R208HCR	14	20.00x20.00x8.00 (508x508x203)	A-20P20	17.00x17.00 (432x432)	21 00x13.00 (533x330)	22.00 (559)	17.88x17.25 (454x438)	Not Included	-	3.50 (89)	-
	‡ A-24R208HCR	14	24.00x20.00x6.00 (610x508x203)	A-24P20	21.00x17 00 (533x432)	25.00x13.00 (635x330)	26.00 (660)	21.88x17.25 (556x438)	Not Included	_	3.50 (89)	-
	‡ A-24R248HCR	14	24.00x24.00x8.00 (610x610x203)	A-24P24	21.00x21.00 (533x533)	25.00x17.00 (635x432)	26.00 (660)	21.88x21.25 (556x540)	Not Included	-	3.50 (89)	-
	‡ A-30R248HCR	14	30.00x24.00x8.00 (762x610x203)	A-30P24	27.00x21.00 (686x533)	31.00x17.00 (787x432)	32.00 (813)	27.88x21.25 (708x540)	Not included	-	3.50 (89)	-
	A-30R3012HCR	14	30.00x30.00x12.00 (762x762x305)	A-30P30	27.00x27.00 (686x686)	31 00x27.00 (787x686)	32.00 (813)	27.88x27.25 (708x692)	Not included	7.00 (178)	1.50 (38)	13.50 (343)
>	‡ A-36R2412HCR	14	36.00x24.00x12.00 (914x610x305)	A-36P24	33.00x21.00 (838x533)	37.00x17.00 (940x432)	38.00 (965)	33.88x21.25 (861x540)	Not Included	_	3.50 (89)	-
	A-36R3012HCR	14	36.00x30.00x12.00 (914x914x305)	A-36P30	33.00x27.00 (838x686)	37.00x27.00 (940x686)	38.00 (965)	33.88×27.25 (881×692)	Not included	9 00 (229)	1.50 (38)	13.50 (343)
	A-42R3012HCR	14	42.00x30.00x12.00 (1067x914x305)	A-42P30	39.00x27.00 (991x686)	43.00x27.00 (1092x686)	44.00 (1118)	39.88x27.25 (1013x692)	Included	9.88 (251)	1.50 (38)	13.50 (343)
	A-36R3612HCR	14	36.00x36.00x12.00 (914x914x305)	A-36P36	33.00x33.00 (838x838)	37.00x27.00 (940x686)	38.00 (965)	33.88x33.25 (861x845)	Not Included	9.00 (229)	4.50 (114)	13.50 (343)
	A-42R3612HCR	14	42.00x38.00x12.00 (1067x914x305)	A-42936	39.00x33.00 (991x838)	43.00x27.00 (1092x686)	44.00 (1118)	39.88x33.25 (1013x845)	Included	9.88 (251)	4.50 (114)	13.50 (343)
	A-48R3612HCR	14	48.00x36.00x12.00 (1219x914x305)	A-48P36	45.00x33.00 (1143x838)	49.00x27.00 (1245x686)	50.00 (1270)	45.88x33.25 (1165x845)	Included	11.38 (289)	4.50 (114)	13.50 (343)
	A-60R3612HCR	14	60.00x36.00x12.00 (1524x914x305)	A-60P36	57.00x33.00 (1448x838)	61.00x27.00 (1549x686)	62.00 (157 5)	57.88x33.25 (1470x845)	Included	14.38 (365)	4.50 (114)	13.50 (343)
	★ A-30R3016HCR	14	30.00x30.00x16.00 (762x762x406)	A-30P30	27.00x27.00 (686x686)	31 00x27.00 (787x686)	32.00 (813)	27.88x27.25 (708x692)	Not included	700 (178)	1.50 (38)	13.50 (343)
	★A-36R3616HCR	14	36.00x36.00x16.00 (914x914x406)	A-36P36	33.00x33.00 (838x838)	37 00x27 00 (940x686)	38.00 (965)	33.88x33.25 (861x845)	Not included	9 00 (229)	450 (114)	13.50 (343)

Millimeter dimensions () are for reference only; do not convert metric dimensions to inch.

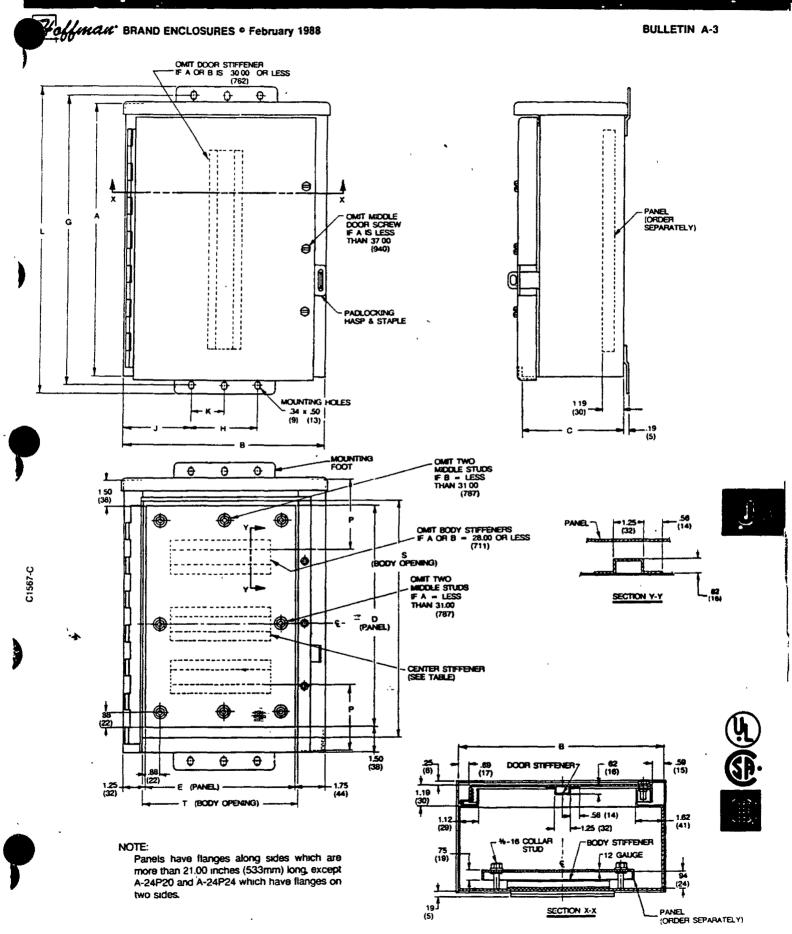
* Panels must be ordered separately. Optional aluminum and plywood panels are also available for most sizes. See Accessones.

‡ Certified by Canadian Standards Association. Specify CSA label when ordering.

*NEW CATALOG ITEMS.

C-TV-12

Control Panel



C-IV-13

Verbatim

... the best thing between you and remote facilities

The Verbatim Automatic Dialing Remote Monitoring System is a giant step forward in voice synthesized alarm systems. Verbatim combines new levels of alarm message clarity and versatility with extended programming capabilities and simplified operation. The result is simple, affordable, and effective monitoring of your remote or unattended facilities—today, and well into the future.

At last ... exact alarm messages, in your own voice

Verbatim provides unlimited versatility in alarm messages. You're no longer restricted to a limited vocabulary of built-in words. Using advanced digitized voice technology, Verbatim accurately stores in memory anything that can be spoken—from names and numbers to technical terms and detailed instructions.

Messages are delivered with maximum clarity—accurately replicating the original speaker, so there's less chance for misunderstanding or error. And, you can easily enter or change messages at the front panel or remotely from any Touch Tone telephone.

Automatic alarm notification, convenient acknowledgement

When an alarm condition occurs, Verbatim automatically calls you with the necessary reports using a standard dial-up telephone line. The system dials up to sixteen field-programmable phone numbers—up to 60 digits each—to report the station identification and specific alarm condition.

Acknowledgement of an alarm phone call is accomplished by pressing a button on the called phone while the alarm is being received or by calling the reporting unit after having received the call.

Easy programming for customized functions

With Verbatim's voice guidance you can quickly enter dial-out phone numbers, record "alarm" messages, and establish alarm trip delays. All system operating parameters are preprogrammed, but may be altered from their default values to meet your needs.

Further, each channel can be independently programmed for one of five different functions; alarm on open circuit, alarm on closed circuit, report on inquiry only, accumulate total running time, or totalize pulses.

Keeping pace with changing needs

Facilities change. Monitoring requirements change. You need a system that easily and inexpensively adapts to new demands. In addition to its programming flexibility, Verbatim's modular design simplifies field upgrading. For

additional input channels. For supervisory remote control (digital outputs). For analog inputs. Or for communications with remote computers, terminals and printers.

Remote Alarm Dialing Monitor with Solid State Message Recording

Complete status reports at any time – from any phone

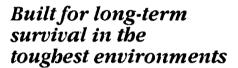
With Verbatim, you're never out of touch with your monitoring system. Any telephone—anywhere—provides access to a comprehensive status report on all conditions monitored by the system, including internal power status. The touch of a telephone key also allows you to review and alter programming such as phone numbers, messages, etc., or even to listen—via a built-in microphone—to local sounds. Personnel at the remote site can communicate with the caller using the unit's built in speakerphone.

For on-site personnel, a glance at the system's front-panel LED indicators provides clear indication of proper system operation, alarm status and battery condition.

Remote Alarm Dialing Monitor

C-I-2

- Superior surge protection on power, phone, and all alarm input lines keeps your VERBATIM on the job!
- Expansion slots for optional plug-in modules give you flexibility and eliminate obsolescence.
- Digitally recorded user messages allow unlimited vocabulary.



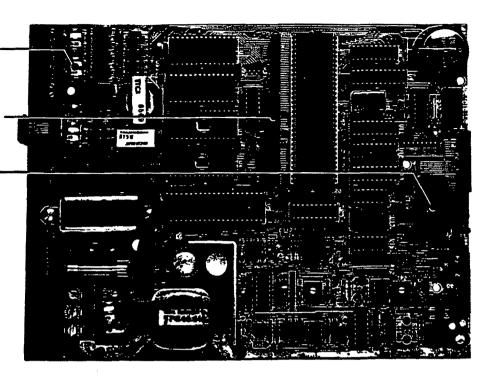
Verbatim is designed and built for superior performance year after year. The system's rugged durability is evident in its heavy duty metal enclosure, carefully selected and proven solid-state components, and sealed membrane keyboard. The unit is protected from electrical surges by heavy duty solid-state and gas tube surge protection—integrated into the main circuit board—for all lines: power, phone and signal input lines.

Battery backup for - safety during power failure

Should a power failure occur, Verbatim's rechargeable gel-cell battery maintains full system operation for up to 20 hours of continuous operation. And, because the system uses a precision regulated charger instead of a traditional "trickle" charger, charging time is minimized and battery life is significantly extended.

Non-volatile memory retains programming — for years— without power

Verbatim's non-volatile memory eliminates the need to reprogram following power outages. Recorded alarm messages and user-entered programming are retained for years—even in the total absence of power to the system.



Programmable Features:

•	
FEATURE	RANGE OF PROGRAMMING
Alarm Criteria	Alarm on Open Circuit Alarm on Closed Circuit Status only Run Time Meter Totalizer
Alarm Reset	ON/OFF
Alarm Reset Time	0.1 to 99.9 hours
Alarm Trip Delay	0.1 to 999.9 seconds
Alarm System Enable/Disable	Local and Remote Enable or Disable
Autocall Test	ON/OFF
Autocall Time Interval	0.1 to 99.9 hours
Call Back/Call Forward	Separate unique telephone number
Dialing Format	Touch Tone or Rotary Pulse
Message Recording Time	User Variable
# of Message Repetitions	1 to 20 repetitions
Phone Numbers	16 phone numbers up to 60 digits each
Ring Delay	1 to 20 rings
Security Code	6 digits
Station ID Recording Time	User Variable
Time Between Alarm Calls	0.1 to 99.9 minutes

C-I-3

Verbatim

Features:

Monitors 4 channels plus internal AC power

Solid-state message recording

Expandable modular design

Superior surge protection on all inputs

Alarm call grouping

Low cost

Remote programming

Nonvolatile memory

20 hour battery backup

5 year warranty

Typical Monitoring Applications:

Boilers

Chemical Plants

Computer Rooms

Facility Security

Fish Hatcheries

Frozen Food Storage

HVAC Systems

Hydroelectric Power Stations

Pipeline & Compressor Stations

Remote Pump Stations

Storage Tanks

Telephone Switchgear

Unattended SCADA Systems

Water & Wastewater Treatment Plants

Typical Sensors:

Flow

Power

Leak

Pressure

Level

Temperature

Motion

Vacuum

pН

Standard Specifications

ELECTRICAL

- Power requirement: 105-135 VAC. 50/60 Hz, 15 watts maximum or 8-14 VDC at 500 mA maximum.
- Battery charging: Precision voltage controlled, including automatic rapid recharge after drain.
- ☐ Battery backup: 20 hours
- ☐ Input sensing: Four unpowered contact inputs standard. Open contacts see 5 volts DC; closed contacts see 10 ma DC.
- ☐ Standard Centronics parallel.

PHYSICAL

- Surge protection: Integral gas tube and solid-state protectors on all phone, power, and signal lines.
- Accommodates field-installed upgrades
- Rugged metal indoor enclosure.
- Weight: 8 lbs. (3.6 kg).
- ☐ **Dimensions:** 117/4"H x 91/4"W x 5"D
- ☐ Mounting centers: 11 '/s" vertical x 6" horizontal.

ENVIRONMENTAL

- ☐ Temperature range: 20 to 130°E
- ☐ Humidity: 0 to 95%, noncondensing.

TELEPHONE

- Rotary pulse or tone dialing, keyboard selectable.
- Dials up to 16 different numbers, each up to 60 digits long.
- Allows programming of PBX delays in 1 second increments.
- ☐ FCC Registered Part 68, "Ringer Equivalence": 0.3A.
- ☐ Alarm Acknowledgement is by TouchTone key or by calling back.
- Built-in speaker phone allows two-way conversation.
- Compatible with most cellular telephone systems.

SPEECH MESSAGES

Users record their own messages. Also, includes resident vocabulary for programming guidance and for default "alarm/normal" speech if no user messages are recorded.

WARRANTY

☐ Five year parts and labor warranty: See our separate warranty card for details

MODULAR OPTIONS

- Analog. Custom scaled in the units of measurement required for your job Analog alarms on a high and a low alarm setpoint. Upgradeable to 1,4,8, or 16 analog channels.
- Remote Supervisory Control. The operator can turn equipment on or off via any telephone. Upgradeable to 4 or 8 outputs.
- Channels. Upgradeable to 8, 16, 24, or 32 contact channels.

FACTORY OPTIONS

- ☐ Enclosure. System available in NEMA 4X enclosure, which is corrosion proof and sealed against 12 feet of water.
- Environmental. Thermostatically controlled heater available, suggested for operation below 20°F or where condensation may occur.
- Local Alarm Relay Output, Relay activates during unacknowledged alarm conditions.



REMOTE ALARMS AND CONTROLS
RACO MANUFACTURING AND ENGINEERING CO.

1400-62nd Street • Emeryville, CA 94608 (510) 658-6713 • FAX: (510) 658-3153

1-800-722-6999

Represented in your area by:

© Copyright 1994 Raco Manufacturing and Engineering Co Specifications subject to change without notice Touch Tone is a registered trademark of AT&T Printed in U.S.A. 1/96 #118

C-V-4

DCS™ Dual Containment System





PLEXCO DCS™ Dual Containment Piping System

A TOTAL SYSTEM APPROACH.

The PLEXCO Dual Containment System presents a unique, total system approach for environmental protection. The system is designed for installation ease, and maximum integrity. Manholes, clean-outs, drain and alarm access points are an integral part of the system. Pipes and fittings are PLEXCO manufactured with the carrier installed and supported in the containment pipe, then shipped as "sticks and kits?

Field installers join each pipe individually with proven heat fusion procedures. Simultaneously fused carrier and containment joints do not allow inspection

of critical carrier joints. Individual joining of carrier and containment allows visual inspection of each joint before closing the system. This ioining method ensures the integrity and full pressure capacity of the carrier pipe. The containment pipe is fusion joined around the carrier using split-ring heaters, or the exclusive PLEXCO Dual Containment Field Joint Kit.

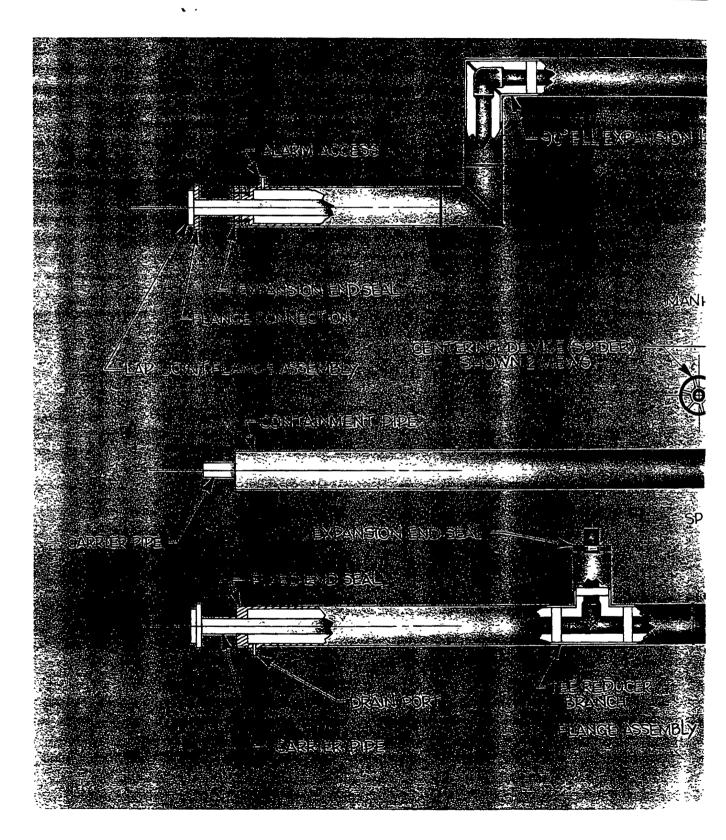
The PLEXCO DCS system insures that in case of carrier pipe failure, any potential leakage is contained. Leak detection and alarm systems, provided by many quality firms, can be installed in the annulus. These detection and alarm systems inform the owner of any problems within the piping system.

A PROVEN MATERIAL AND DESIGN.

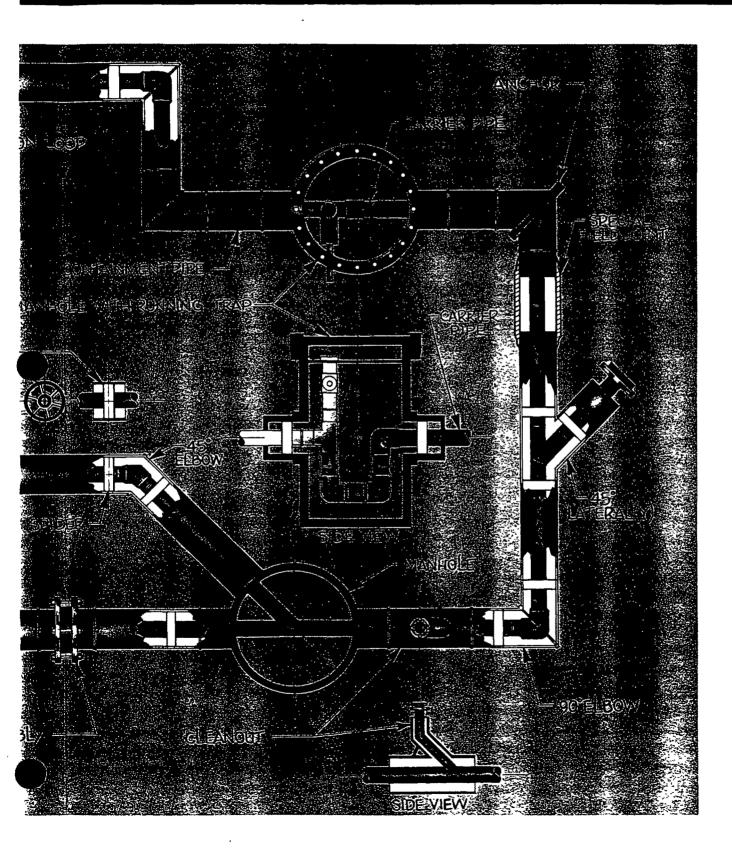
Because of their outstanding chemical resistance, polyethylene and polypropylene have handled hazardous chemical fluids for many years. Federal or State statutes now, or soon will require dual containment for underground piping that transports hazardous materials. The PLEXCO DCS system is dedicated equipment for the protection of the environment.

PLEXCO DCS is a dual containment piping system that satisfies both Federal and State requirements of the Resource Conservation and Recovery Act (RCRA) including the new sub-titles to the Federal Hazardous Waste statutes.

This bulletin is intended to be used as a guide to support the designer of a dual containment pipe system. It is not intended to be used as installation instructions, and should not be substituted in place of the advice of a professional design engineer.









Dual Containment Standard System

PRESSURE REQUIREMENTS

The PLEXCO Dual Containment System is available as two standardized carrier pipe systems:

LP is a gravity carrier system with a 15 psi maximum test pressure.

HP is a pressure carrier pipe with system service pressure rating up to 160 psi.

DI	CS Class	Pressure
Carrier	Containment	Range (psi)
LP	1	Gravity
LP	2	Gravity
HP	1	160
HP	2	160

MATERIALS

The standard material for both carrier and containment pipe is:

PLEXCO EHMW PE3408 high density polyethylene.

Available materials for both carrier and containment pipe are:

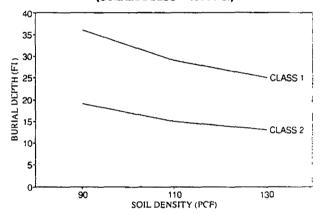
- □ PLEXCO HTPE™ high temperature polyethylene;
- ☐ PLEXCO PE2406 medium density polyethylene:
- □ PLEXPRO CP, a high impact polypropylene copolymer for low pressure, high temperature service.

BURIAL CONDITIONS

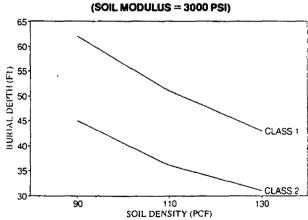
LP and HP carrier systems are available with either Class 1 or Class 2 containment pipe. In general, Class 1 is for heavy earthloads, and Class 2 is for lighter earth loads. There are many variables that can determine actual burial

conditions, including embedment compaction, burial depth, soil type and temperature. The following graphs demonstrate the burial depth capabilities of DCS Class 1 and Class 2 containment pipe under specific soil conditions.

MAXIMUM BURIAL DEPTH (SOIL MODULUS = 1000 PSI)



MAXIMUM BURIAL DEPTH (SOIL MODULUS = 3000 PSI)





CUT BACKS

The PLEXCO Dual Containment Pipe System is designed to accommodate an easy fusion in the field by the joiner. Therefore, all pipes are supplied with an appropriate cutback on both ends to accommodate the required length needed for most available fusion machines. On special request, PLEXCO can supply straight pipe lengths without cutback. There are some restrictions on where they can be used due to lack of cutback. Refer to DCS Engineering Manual or contact PLEXCO Technical Service Representatives for appropriate applications.

PIPE DIMENSIONS

IPS	CARRIER PIPE	CONTAINMENT PIPE
1"/4"	1.315"	4.500"
2"/5"	2.375"	5.563"
2"/6"	2.375"	6 625"
3"/7"	3.500"	7.125"
3"/8"	3.500"	8 625"
4"/8"	4 500"	8.625"
6"/10"	6.625"	10.750″
8"/14"	8 625"	14 000"

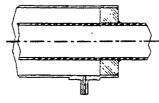
Large diameters available on request.

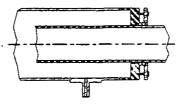
Carrier pipe available in pressure ratings up to 160 psi.

Standard containment pipe rated at 15 psihigher rating upon request.

END SEALS

Both fixed and expansion end seals are available. For containment termination, fixed end seals anchor the containment and carrier together. The PLEXCO DCS **Expansion End Seal** (design patent pending) allows longitudinal movement between the carrier and containment pipe. Alarm and drain ports are optional.

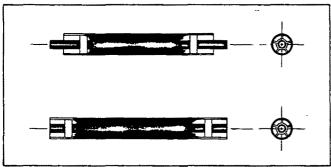




Fixed End Seal (top) Expansion End Seal (bottom)

COMMITTMENT TO QUALITY

The PLEXCO Dual Containment System reconfirms PLEXCO's dedication and commitment to quality products. total system design, and service before and after the sale. PLEXCO Technical Services Representatives can assist you with design, specification, installation, and heat fusion training services. Please call (708) 455-0600 for additional information or service.



Piping with Cutback (Top) Piping without Cutback (Bottom)



Performance Pipe Division - Chevron Chemical Company 1050 Busse Highway, Suite 200 Bensenville, Illinois 60106 (708) 350-3700 FAX (708) 350-2704





HDPE PIPING

HDPE Piping

3

ORDER INFORMATION & PIPE DATA

ORDER INFORMATION

To assure expedient handling, please state:

PIPE OR TUBING FOOTAGE: IPS OR CTS SIZE: SDR OR MINIMUM WALL: COIL LENGTH OR STRAIGHT LENGTH: DESIRED SHIPPING DATE AND DESTINATION.

Minimum Order: \$100.00

Please send orders to:

P. O. Box 608 State Highway 32 Abbeville, SC 29620 (803) 446-2136

1280 Jesterson Lane Colton, CA 92324 (714) 370-1881

1 E. Highway 31 reicena. TX 75110 , #03) 874-5622

1806 West Stone Avenue Fairfield, IA 52556 (515) 472-3137

Or: P. O. Box 23530 Knoxville, TN 37933 (615) 966-5822

Other sizes and SDR's are available on special order. Write or call for price and delivery.

All orders are subject to PLEXCO acceptance and current conditions of sale.

PACKAGING DATA

SILO PACK is a vertical stack of colls strapped to a nonreturnable pallet. BULK PACK is a rectangular bundle of straight lengths of pipe secured with wood members and strapping.

SILO PACKS and BULK PACKS may be combined when feasible to achieve Truckload requirements.

COIL	E D PI	PE & TU	BING	1			
NOMINA		A HE			AYC		POUNDS
2 P P P P P P P P P P P P P P P P P P P	(11)		SUNTING.	0.00			7
1/2" CTS	7.0	500	947907	.625"	.439"	.090"	.07
		1000	947915				
3/4° CTS	9.7	500	947923	.875"	.685"	.090*	.10
1. CL2	11.0	500	947958	1.125"	.911"	.102*	.14
1-CIS	12.5	500	947931	1.125"	.935"	.090*	.13
1-1/4" CTS	15.3	500	947966	1.375"	1.185*	.090"	.16
1/2" IPS	9.3	1000	947974	.840"	.650"	.090*	.09
3/4" IPS	11.0	500	947982	1.050*	.848"	.095"	.12
1" IPS	11.0	500	948029	1.315"	1.061*	.119"	.19
1-1/4" IPS	11.0	500	948045	1.660"	1.340	.151"	.31
2" IPS	11.0	350	942137	2.375*	1.917*	.216	.54
		500	942145				
		1500	942153				
3" IPS	11.0	500	948141	3.500"	2.856"	.318"	1.39
		1000 .	901836				

STR	AIGHT	LENG	THS	PIPE DATA					
					275 / eW				
SVAS		Richitan;	e Soyman						
2" IPS	11.0	20	902330	2.375"	1.917*	216	0.64		
3" IPS	11.0	40	948168	3.500°	2.826*	.318"	1.39		
4° IPS	11.0	40	948192	4.500"	3.632"	.409"	2.30		
4" IPS	13.5	40_	948213	4.500*	3.794"	.333*	1.90		
6" IPS	11.0	40	948256	6.625"	5.349"	.602"	4.97		
6" IPS	13.5	40	948272	6. 625"	5.585"	.491"	4.13		
8° IPS	11.0	40	948301	8.625"	6.963"	.785*	8.43		
8" IPS	13.5	40	948328	8.625*	7.271"	.639°	7.00		
12" IPS	11.0	40	900554	12.750"	10.293"	1.160"	18.43		
12" IPS	13.5	40	900558	12.750"	10.749*	.945"	15.31		

C-I-12

PE 3408 Industrial Piping System Pipe Data and Pressure Ratings

Bulletin No. 301



(Pipe weights are calculated in accordance with PPI TR-7) Average inside diameter calculated on minimum wall plus 6%. Pressure Ratings are for water at 73°F. For other fluids and service temperatures ratings may differ, refer to Application Note No. 6 Chemical and Environmental Considerations.

	sure ling		100 psl DR 17.0			80 psi DR 21.0			65 psi DR 26.0			50 psi DR 32.5			40 psi DR 41.0		
IPS*	Nominal	Minimum	Average	Weight LB/FT	Minimum Wall (In.)	Average ID (in)	Weight LB/FT	Minimum Wall (in.)	Average ID (in)	Weight LB/FT	Minimum Wall (in)	Average ID (in.)	Weight LB/FT	Minimum' Wall (in.)	Average ID (in)	Weight LB/FT	IPS* Pipe Size
Pipe Size	OD (in)	Wall (in)	ID (In)	LB/F1	AABII (III.)	in (iii)	LB/FI	AASH (III')	, 10 (iii)	LD/F1	vvaii (iri)	io (ii.)	LB/F1	AARII (III.)	10 (11)	LB/F1	1½*
11/4"					3.7			 		 							1%
2*	2 375	0.140	2.078	0.43	14.14						1 3			343.6% no			2.4
3°	3 500	0.140	3 063	0.93	State of the state		 				 			30 81 12			3"
4"	4 500	0.206	3.938	1 54	0.214	4.046	1 26	 		 	á.		 	\$ 1 X	<u> </u>		4-> 1
5%*	5 375	0.316	4.705	2 20	0.256	4.832	1 80	0.207	4 936	1 47	(35)						5X*
5*	5 563	0.316	4.705	2 35	510,265	5.001	1 93	0.207	5.109	1 58	1 漫家の			體分子			3.5°47
6 *	6 625	0.327	5.796	3 34	0.315	5.957	2 73	0.214	6 084	2 23	0.204	6.193	1.80	17 次 7			6"
7%*	7 125	0.390	6.237	3.86	0.339	6.406	3 16	0.274	6.544	2 58	0.219	6.661	2 08				7%"
8"	8 625	0.507	7.550	5 65		7.754	4 64	. 0.332	7.921	3 79	0.265	8.063	3 05	監理 10	 		8"
10*	10 750	0.632	9.410	8 78	0.411	9.665	7 21	0.332 0.413	9.874	5 87	0.331	10.048	4.75	新 斯·汤			<u> </u>
	12 750	0.750	11.160	12 36	0.607	11.463	10.13	0.490	11.711	8 26	0.392	11.919	6 67	A CONTRACTOR			10
12"				13 60	0.637	12.025	11.15	. 0.514	12,285	9 09	0.352	12.502	7.35				<u> </u>
13%"	13 375 14 000	0.787	11.707 12.253	14.91	. 0.667	12.586	12 22	0.538	12.859	9.96	0.431	13.086	8 05	· (1) (1) (1) (1) (1) (1) (1) (1) (1) (1)			13%;
16"	16 000	0.941	14.005	19.46	0.762	14.385	15 97	0.536	14.696	13 02	0.492	14.957	10 51	<u> </u>		ļ	16"
18*	18 000	1.059	15.755	24 65	0.857	16.183	20 19	0.613	16 533	16 48		16.826	13 29	iga, e, c			
20*	20 000	1.059	17 507	30 42	0.857	17.982	24 92	0.892	18 370	20 34	0.554 0.615	18 696	16 41	1			18* 20*
22*	22 000	1.176	19 257	36 81	1.048	19 778	30 19	0.765	20 206	24 62	0.677	20 565	19 87	3. "			22"
24"	24 000	1.412	21.007	43 82	1.143	21.577	35 92	0.923	22.043	29 29	0.738	22.435	23 62				24"
126"	26 000	1.529	22.759	51 40	1.238	23 375	42 13	1.000	23.880	34 39	0.800	24.304	27 74	<u> </u>			126*
†28"	28 000	1.647	24 508	59 62	1.333	25.174	48 86	1.077	25 717	39.89	0.862	26.173	32 20	 			128"
130"	30 000	1.765	26.258	68.45	1.429	26.971	56 13	1.154	27.554	45 78	0.923	28.043	36 92	0.732	28.448	29 50	130"
†32"	32 000	1.882	28.010	77 86	, 1.524	28.769	63 83	1.231	29.390	52 10	0.985 🐠	29.912	42 04	4 0.780	30.346	33,53	t32*
134*	34 000	2.000	29.760	87.91	1.619	30 568	72 06	1.308	31.227	58 79	1 046 ¹⁾⁸	31.782	47.44	0.829	32.243	37 87	134**
136"	36 000	2.118	31 510	98 56	1.714	32 366	80 79	1.385	33.064	65 93	1.108	33.651	53 18	0.878	34.139	42 47	†36"
142"	42 000				2.000	37.760	109 97	1.615	38.576	89 71	1.292	39.261	72 40	71.024	39.829	57 74	†42"
148"	48 000				2.286	43 154	143 64	1.846	44.086	117 20	1.477	44.869	94 58	1.171	45.517	75 48	148"
†54 "	54 000				2.571	48 549	181 74	2 077	49 597	148 35	1.662	50.477	119 72	1.317	51.208	95 52	154"

^{*} Industrial PE (polyethylene) pipe sizes are identified by IPS (fron pipe size) diameters which designate the nominal diameter for 12* IPS AND SMALLER PIPE, AND 0.0 (outside diameter) for 14* IPS and larger pipe

PLEXCO can produce to specialized pipe dimensions. Check with your PLEXCO sales office for availability of dimensions not listed.

† SUBJECT TO MINIMUM ORDER QUANTITIES, AND AVAILABILITY OF TOOLING.

PVC SCHEDULE 80 PIPE

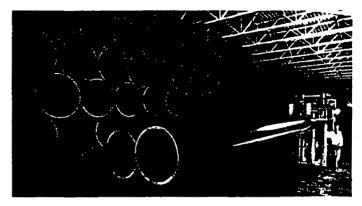
SPECIFICATIONS

ASTM: The material used in the manufacture of pipe for Ryan Herco Products Corp. will meet ASTM-D-1784-65T for a PVC Type 1 material. The Schedule 40 and Schedule 80 Pipe conforms to ASTM-D-1785.

CS (Commercial Standard): CS-207-60 is the industry standard for Schedule 40 and Schedule 80 PVC pipe and is met by pipe from the Ryan Herco Products Corp. in both schedules. PVC pipe meeting this specification has the same O.D. and I.D. as the corresponding schedule of iron or galvanized pipe.

All PVC pipe except 1/8*, 1/4* and 3/8* sizes are NSF-approved for potable water.

NOT RECOMMENDED FOR COMPRESSED AIR OR GASES



3905-(Size No.) PVC HEAVY WALL PIPE, SCHEDULE 80 3907-(Size No.) HARVEL HIGH QUALITY PVC, SCHEDULE 80

Standard Length: 20 ft.

	Nom.			Min.			Price p	er Foot
Size No.	Pipe Size (ln.)	O.D. In. (mm)	Avg. LD. in. (mm)	Wall Thick. In. (mm)	Nom. Wt. (lbs./ 100 ft.)	Max. Work Pressure (psi)*	3905	3907
-001 -002 -003	产 1/8 ± 1/4 毫 3/8 €	0.405 (10.3) - 0.540 (13.7) - 0.675 (17.1)	0.203 (5.2) 0.282 (7.2) 203 (10.2)	0.095 (2.4) 0.119 (3.0) 0.128 (3.2)	5 5.8 9.8 13.6	1225 1130 920	\$.42 .51 .70	\$.75 1.06 1.43
-005 -007 -010	1/2 3/4 1	0.840 (21.3) 1.050 (26.7) 1.315 (33.4)	0.526 (13.4) 0.722 (18.3) 0.935 (23.7)	0.147 (3.7) 0.154 (3.9) 0.179 (4.5)	20.5 27.8 40.9	850 690 630	.33 .45 .66	.42 .57 .83
01 ×	1-1/4 1-1/2 2	1.660 - ((22) 900 - ((850) 2375 - ((03)		0.00 E (0) 0.200	50.5: 60.5:	520 470 400 8	900 1.11 21.53	1.15 1.37 1.91
-025 -030 -040	2-1/2 3 4	2.875 (73.0) 3.500 (88.9) 4.500 (114.3)	2.291 (58.2) 2.864 (72.7) 3.786 (96.2)	0.276 (7.0) 0.300 (7.6) 0.337 (8.6)	144.8 193.7 283.1	420 370 320	2.33 3.12 4.55	3.06 3.89 5.69
080 080 080	5 6 8		Trees	0. (0.0) 0.4 (1.0) 0.5 (1.27)		290VE 	(9.65 (8.70 13.57	9.65 10.85 18.44

SCH. 80 LARGE-DIAMETER PROCESS PIPE

100	10 12	0.760 (2KD)		(Elsen)	0.583				19.80 27.23	\$27.84 38.27
-140	14	14.000 (355.6)	12.410	(315.2)	0.750	(19.1)	1979.0	220	_	53.42
-160	16	16.000 (406.4)	14.214	(361.0)	0.843	(21.4)	2543.0	220	_	67.31
-180	18	18.000 (457.2)	16.014	(406.8)	0.937	(23.8)	3183.0	220	_	84.25

^{*} The maximum working pressure is calculated at 73°F. See General Information Section to derate for higher temperatures. Minimum available quantity is one length.

HARVEL HIGH QUALITY PVC SCHEDULE 80 PIPE

- Highest quality best appearance.
- · Cosmetic applications.
- Special storage and shipping.

More than 30 years of thermoplastic processing experience makes Harvel pipe the leader in quality product. Only the finest domestic raw material compounds are selected and carefully blended to assure consistent physical properties from run to run. State-of-the-art processing and testing equipment are combined with comprehensive quality assurance programs to

meet industry expectations. To further insure quality, unannounced inspections are conducted routinely by independent third parties such as NSF and UL.

Harvel's technical team provides reliable answers to tough questions regarding material selection, product application system

system duct is ection, uperior

PVC Piping





C-V-13







SPECIFICATION NO. 02100 SITE PREPARATION

Part 1	Gener 1.01 1.02	ral Summary Scope of Work	1 Page
Part 2	Produ	cts	
	2.01	Materials	
		SPECIFICATION NO. 02200	
		SITE WORK	
Part 1	Gener	ral	4 Pages
	1.01	Summary	
	1.02	Definitions	
	1.03	Codes and Standards	
Part 2	Produ	cts	
	2.01		
	2.02	Crushed Rock or Drainage Fill	
•	2.03	· · · · · · · · · · · · · · · · · · ·	
Part 3	Execu	ation	

3.01 General

SPECIFICATION NO. 02230 DRILLING, WELL INSTALLATION, WELL DEVELOPMENT AND AQUIFER TESTING

Gener	al	10 Pages
1.01	Summary	_
1.02	Acronyms, Definitions, and Standards	
1.03	Location	
1.04	Access	
1.05	Safety and Health	
Product	S	
2.01	Equipment Furnished By the Contractor	
2.02	Materials Furnished By the Contractor	
2.03	Equipment and Materials Furnished by Others	
Execu	tion	
3.01	General	
3.02	Personnel and Supervision	
3.03	Drilling	
3.04	Monitoring Well Design and Installation	
3.05	Well Development	
3.06	Acceptance Criteria	
3.07	Aquifer Test	
3.08	Decontamination	
3.09	Reporting Requirements	
	Figures	
	1.01 1.02 1.03 1.04 1.05 Product: 2.01 2.02 2.03 Execus 3.01 3.02 3.03 3.04 3.05 3.06 3.07 3.08	1.02 Acronyms, Definitions, and Standards 1.03 Location 1.04 Access 1.05 Safety and Health Products 2.01 Equipment Furnished By the Contractor 2.02 Materials Furnished By the Contractor 2.03 Equipment and Materials Furnished by Others Execution 3.01 General 3.02 Personnel and Supervision 3.03 Drilling 3.04 Monitoring Well Design and Installation 3.05 Well Development 3.06 Acceptance Criteria 3.07 Aquifer Test 3.08 Decontamination 3.09 Reporting Requirements

D-1

D-2

D-3

Site Location

Extraction Well Design

Well Locations and Estimated Capture Zones

SPECIFICATION NO. 02831 CHAIN LINK FENCE AND GATE

Part 1	General	2 Pages
--------	---------	---------

1.01 Summary

1.02 Codes and Standards

Part 2 Prodcuts

2.01 Materials

Part 3 Execution

3.01 Installation

SPECIFICATION NO. 03300 CAST-IN-PLACE CONCRETE

Part 1 General 5 Pages

1.01 Summary

1.02 Codes and Standards

1.03 Requirements

1.04 Submittals

Part 2 Products

2.01 Concrete

Part 3 Execution

3.01 General

3.02 Quality Assurance

nec \docsprog\specstoc doc

SPECIFICATION NO. 05510 CANOPY

Part 1	Gener	ral	2 Pages
	1.01	Summary	J
	1.02	Scope of Work	
	1.03	Codes and Standards	
	1.04	Submittals	
Part 2	Produ		
	2.01	Roof Materials	
	2.02	Support Structure	
	2.03	Fabrication	
Part 3	Execu		
	3.01	General	

SPECIFICATION NO. 11325 GROUNDWATER TREATMENT EQUIPMENT

Part 1	General						
	1.01	Summary	3 Pages				
	1.02	System Description					
Part 2	Products						
	2.01	Groundwater Treatment Equipment					
	2.02	Cartridge Filter (CF-201)					
	2.03	Activated Carbon Adsorption System (GAC-201)					
Part 3	Execu	ation					
	3.01	Installation					
	3.02	Testing					

nec \docsprog\specstoc doc

SPECIFICATION NO. 15010 GENERAL MECHANICAL REQUIREMENTS

Part 1	Gener	ral	7 Pages
	1.01	Summary	Ū
	1.02	Regulatory Requirements	
	1.03	Quality Assurance	
		Delivery, Storage, and Handling	
	1.05	Codes and Standards	
Part 2	Produ	acts	
	2.01	Materials and Equipment	
		Liquid Transfer Pumps	1
	2.03	Spare Parts and Special Tools	
Part 3	Execu	ution	
•	3.01	General	
	3.02	Equipment and Piping Installation	
		Tests and Adjustments	
	3.04	Protection and Cleaning	
	3.05	Related Electrical Work	
		SPECIFICATION NO. 15410	
		PIPING AND VALVE MATERIAL AND INSTALLATION	

Part 1	Gener	ral'	8 Pages					
	1.01	Summary						
	1.02	Scope of Work						
	1.03	Codes and Standards						
	1.04	Drawing						
	1.05	Shipping, Storage and Handling						
Part 2	Products							
	2.01	Piping, Fittings and Valves						
Parat 3	Execu	ition						
	3.01	General						
	3.02	Inspection and Examination						
	3.03	Erection						
	3.04	Support and Anchors						
	3.05	Testing						

SPECIFICATION NO. 15976 LOCAL CONTROL PANELS

Part 1	Gener	ral	6 Pages
	1.01	General Requirements	_
	1.02	Submittals	
	1.03	Codes and Standards	
	1.04	Crating and Shipping	
Part 2	Produ	acts	
	2.01	Design and Construction	
	2.02	Cabinet Construction	
	2.03	Nameplates	
	2.04	Terminal Blocks	
	2.05	Ground Busses	
Part 3	Execu	ution	
	3.01	Instrument Mounting	
	3.02		
	3.03	System Test	
•			
		SPECIFICATION NO. 15977	
		GENERAL INSTRUMENTS AND CONTROLS	
Part 1	Gener	ral	7 Pages
	1.01	General Requirements	
	1.02	Documents Requirements	
	1.03	Codes and Standards	
	1.04	Preparation for Shipment	
Part 2	Produ	icts	
	2.01	Materials and Equipment Requirements	
	2.02	Identification and Tagging Requirements	
Part 3	Execu	ntion	
	3.01	Maintenance Philosophy	
	3.02	Instrument Calibration	
	3.03	Installation	
	3.04	Inspection and Shop Testing	

SPECIFICATION NO. 15979 CONTROL VALVES

Part 1	Genera	al	5 Pages
	1.01	General Requirements	
	1.02	Work to be Provided	
		Codes and Standards	
		Preparation for Shipment	
Part 2	Produc	ets	
,	2.01	Design Conditions and Performance Requirements	
	2.02	Valve Sizing	
	2.03	Materials and Equipment Requirements	
	2.04	Design and Construction Features	
Part 3	Execut	tion	
	3.01	Shop and Field Testing	
	3.02	Painting	•
		SPECIFICATION NO. 16050	
		BASIC ELECTRICAL MATERIALS AND METHODS	•
Part 1	Genera	ો	6 Pages
	1.01	Summary	
	1.02	•	
	1.03	Submittals	
	1.04	Codes and Standards	
Part 2	Produ	acts	
	2.01	•	
	2.02		
		Outlet and Device Boxes	
	2.04	Pull and Junction Boxes	
	2.05	Precast Concrete Pull Boxes	
	2.06	Wiring Devices	
	2.07	Exterior Lighting	
	2.08	Electric Motors	
Part 3	Execu	ution	

nec \docsprog\specstoc doc

SPECIFICATION NO. 16452 **GROUNDING**

Part 1	General		5 Pages		
	1.01	Summary			
	1.02	References			
	1.03	Submittals			
	1.04	Codes and Standards			
Part 2	Products				
	2.01	Grounding and Bonding Products			
	2.02	Wire and Cable Grounding Conductors			
	2.03	Braided Bonding Jumpers			
	2.04	Bonding Straps			
	2.05	Pressure Connectors			
	2.06	Bolted Clamps			
	2.07	Exothermic-Welded Connections			
	2.08	Grounding Rods			
Part 3	Execution				
	3.01	Equipment Grounding Conductors			
	3.02	Installation			
	3.03	Connections			
•	3.04	Tests			

nec \docsprog\specstoc doc

SPECIFICATION NO. 16470 **PANELBOARDS**

Part 1	General		6 Pages		
	1.01	Summary			
	1.02	References			
	1.03	Submittals			
	1.04	Codes and Standards			
Part 2	Products				
	2.01	Manufacturers			
	2.02	Panelboards			
	2.03	Special Features			
	2.04	Surge Arresters			
	2.05	Lighting and Appliance Branch Circuit Panelboards			
	2.06	Accessory Components and Features			
	2.07	Identification			
Part 3	Execution				
	3.01	Installation, General			
	3.02	Ground Fault Protection			
	3.03	Mounting			
	3.04	Circuit Directory			
	3.05	Wiring in Panel Gutters			
	3.06	Tests			
	3.07	Visual and Mechanical Inspection			
	3.08	Electrical Tests			
	3.09	Retesting			
	3.10	Balancing Loads			

Introduction

Specifications were prepared to describe the SCGWR Final Design equipment for the 501 Ellis Street property. As was noted in Appendix B, the specifications comprise a portion of the design package which NEC will issue to solicit a qualified Remedial Action Contractor (RAC) during the procurement phase of the project. It is the responsibility of the RAC to completely install and connect system equipment and components in accordance with the parameters of the design package, good industrial practices, and the requirements of applicable codes and standards.

D1.1 SCOPE

The specifications are shown in the following log:

Specification Log

Specification No.	Description
02100	Site Preparation
02200	Site Work
02230	Drilling, Well Installation, Well Development, and Aquifer Testing
02831	Chain Link Fence and Gate
03300	Cast-In-Place Concrete
05510	Canopy
11325	Groundwater Treatment Equipment
15010	General Mechanical Requirements
15410	Piping and Valve Material and Installation
15976	Local Control Panels
15977	General Instruments and Controls
15979	Control Valves
16050	Basic Electrical Materials and Methods
16452	Grounding
16470	Panelboards

SPECIFICATION NO. 02100 SITE PREPARATION

PART 1 GENERAL

1.01 Summary

This specification establishes the technical requirements for site preparation.

1.02 Scope Of Work

- A. The following work is included:
 - Protection of existing trees, vegetation, landscaping materials, and site improvements not scheduled for clearing or removal which might be damaged by construction activities.
 - II. Trimming of existing trees and vegetation, as recommended by arborist, for their protection during construction activities.
 - III. Clearing and grubbing of stumps, vegetation, debris, rubbish, designated trees, and site improvements.
 - IV. Topsoil stripping and stockpiling.
 - V. Temporary erosion control, silt control, and dust control.
 - VI. Temporary protection of adjacent property, structures, benchmarks, and monuments.
 - VII. Protection in-place and temporary relocation, storage and re-installation of existing of fencing and site improvements scheduled for reuse.
 - VIII. Watering of designated trees and vegetation during construction activities.
 - IX. Removal and legal disposal of cleared materials.

PART 2 PRODUCTS

2.01 Materials

A. Materials used for tree protection, erosion control, silt control, and dust control as suitable for specific site conditions.

END OF SPECIFICATION NO. 02100

SPECIFICATION NO. 02200 SITE WORK

PART 1 GENERAL

1.01 Summary

This Specification establishes the technical requirements for site work, and includes all earthwork associated with the site and preparation of foundation materials.

1.02 Definitions

Site work definitions include the following:

- A. Excavation: The removal of material encountered to subgrade elevations and the reuse or disposal of materials removed, including existing asphaltic concrete pavement.
- B. Subgrade: The uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
- C. Borrow: Soil material obtained off-site when sufficient approved soil material is not available from excavations.
- D. Unauthorized excavation: The removal of materials beyond indicated subgrade elevations or dimensions without direction.
- E. Trenching and Backfill: Routing of utilities including on-site underground pipes, conduits, ducts, cables, and underground services. Excavation of a trench, preparation of bedding and backfilling to existing grade, including replacement of any paving or ground cover.

1.03 Codes and Standards

A. Perform earthwork complying with requirements of the latest revision of applicable CalTrans and American Society for Testing and Materials (ASTM) standards.

PART 2 PRODUCTS

2.01 Soil Materials

A. Provide approved borrow soil materials from off-site when sufficient approved soil materials are not available from excavations.

2.02 Crushed Rock or Drainage Fill

- Course of granular material placed under slab-on-grade to cut off upward capillary flow of pore water toward slab. Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, ASTM D 448, coarse aggregate grading size 57, with 100 percent passing a 1-1/2-inch sieve and not more than 5 percent passing a Number 8 sieve.
- В. Backfill shall be native material, containing not more than occasional rounded rocks less than 1/2 inch in diameter. Rocks, rubble or asphaltic pavement residue shall not be used
- C. Class 2 Aggregate Base Material shall be in accordance with CalTrans Section 26 of Standard Specifications, 1-1/2 inch maximum size...
- D. Asphaltic Concrete Surfacing shall consist of a mixture of mineral aggregate and paving grade asphalt, mixed at a central plant. The asphalt shall be AR400. The mineral aggregate shall by Type B, 1/2 inch maximum size, medium grading, in accordance with CalTrans Section 39 of Standard Specifications. The prime coat shall be in accordance with Section 39.
- E. Sand Bedding shall be imported sand, having not more than 5% passing a No. 200 sieve.

2.03 Trench Locator Tape

A. The trench locator tape shall be magnetic, installed as shown on the drawings, centered over the pipe(s) and conduit(s) in all trenches.

PART 3 **EXECUTION**

3.01 General

- Protect structures, utilities, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- В. Excavation and Backfilling: Bury piping to a depth of not less than 18 inches below finish grade unless otherwise indicated. Ensure that sand backfill completely surrounds the pipe a minimum of 3 inches in all directions.
- C. Provide erosion and sedimentation control measures. Prevent surface water and subsurface or ground water from entering excavations and from ponding on prepared subgrades.

NEC 501 FSCGWRD 02200-2 Rev.B, 8/26/96

D. Protect subgrades and foundation soils from softening and damage by rain or water accumulation and from freezing temperatures or frost.

- E. Do not use explosives.
- F. Excavate for equipment pads to indicated elevations and dimensions shown on the design drawings. Widen excavations to permit placing and removing concrete formwork, installing services and other construction, and for inspections. Trim subgrades to required lines and grades to leave solid base to receive other work.
- G. Fill unauthorized excavation under equipment pads by extending indicated bottom elevation of concrete foundation or footing to excavation bottom, without altering required top elevation. Fill unauthorized excavations under other construction as directed at Contractor's expense.
- H. Store excavated and borrow soil materials acceptable for backfill and fill in shaped, graded, drained, and covered stockpiles. Locate stockpiles away from edge of excavations and outside drip line of remaining trees.
- I. Backfill excavations promptly following acceptance of affected work below final grade.
- J. Plow strip or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing surface. When subgrade or existing ground surface to receive fill has a density less than that required for fill, break up ground surface to depth required, pulverize, moisture-condition or aerate soil, and recompact to required density as shown on the design drawings.
- K. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer to within 2 percent of optimum moisture content before compaction. Remove and replace, or scarify and air dry, satisfactory soil material that is too wet to compact to specified density.
- L. Place backfill and fill materials in layers not more than 12 inches in loose depth for material compacted by heavy compaction equipment, and not more than 6 inches in loose depth for material compacted by hand-operated tampers. Place evenly alongside equipment pads to required elevations.
- M. Compact soil to not less than the following percentages of maximum dry density in accordance with ASTM D 1557:
 - I) Under equipment pads, compact the top 12 inches below subgrade and each layer of backfill or fill material to 95 percent.

NEC 501 FSCGWRD nec \docsprog\specs\02200 doc

02200-3

Rev.B, 8/26/96

- II) In the utility trench compact the sand bedding around piping and or conduits to 90 percent.
- III) In the utility trench compact the Backfill or the Aggregate Base, in the top one foot to 95 percent and to 90 percent elsewhere.
- IV) Under a slab-on-grade compact the drainage fill to 95 percent.
- N. Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated. Grade lawns, walks, and unpaved subgrades to tolerances of plus or minus 0.10 foot and pavements and areas within building lines to plus or minus 1/2 inch.
- O. Under slabs-on-grade, place drainage fill on prepared subgrade to required cross sections and thickness shown on the design drawings.
- P. Repair and reestablish grades where completed or partially completed surfaces become eroded, rutted, settled, or lose compaction.
- Q. Remove surplus satisfactory soil and waste material, including existing asphalt concrete pavement unsatisfactory soil, existing concrete, trash, and debris, and legally dispose of it properly.
- R. Contractor shall collect excavated soils into stockpiles for sampling by the Engineer. The Engineer will collect one sample for every 25 cubic yards of stockpiled soils. After a laboratory analysis the Engineer will direct the Contractor as to which soils may by used for backfill and which soils must be disposed off-site.

END OF SPECIFICATION NO. 02200

SPECIFICATION NO. 02230 DRILLING, WELL INSTALLATION, WELL DEVELOPMENT AND AQUIFER TESTING

PART 1 GENERAL

1.01 Summary

This Specification provides requirements for the drilling, constructing, developing, and testing of wells at the 501 Ellis Street property in Mountain View, California. The minimum standards of quality, safety, procedure, and performance required to successfully complete the installation and development of two groundwater extraction wells and to conduct aquifer tests at the site are described.

The work to be performed consists of furnishing all supervision, labor, equipment, tools, supplies and materials to complete the wells and test in accordance with the provisions of this Specification. The following work items will be performed: drilling two soil borings to a depth of approximately 30 feet below ground surface; obtaining up to three split-spoon soil samples from each of these borings, installing and developing these extraction wells; and aquifer testing.

1.02 Acronyms, Definitions, and Standards

Following is a list of terms along with definitions as used in this Specification:

"Owner" refers to Renault and Handley, the owners of the property which was formerly leased by NEC Electronics Inc. and is the Jobsite for the work under this Contract.

"Engineer" refers to Bechtel Environmental, Inc. (Bechtel) and any of its authorized geologists, engineers, or other representatives.

"Contractor" refers to the party to whom the Contract for the work herein described has been awarded, and any of its authorized representatives.

"Others" refers to those individuals who are assigned by NEC or Bechtel to perform special tasks.

ASTM: American Society for Testing and Materials;

OSHA: Occupational Safety and Health Administration;

SHO: Bechtel's Safety and Health Officer;

EPA: United States Environmental Protection Agency.

Unless otherwise specified, materials and field operations shall conform to the latest issue of the following ASTM codes and standards and shall apply to the extent indicated herein:

NEC 501 FSCGWRD

nec \(\text{locsprog\specs\(\text{locsprog\(\text{locsprog\specs\(\text{locsprog\(\text{locsprog\(\text{locsprog\(\text{locsprog\(\text

ASTM C 150 Portland Cement;

ASTM D 653 Terms and Symbols Relating to Soils and Rock Mechanics;

ASTM D 1586 Standard Method for Penetration Test and Split Barrel Sampling of Soils (adapted for a modified California split-spoon sampler using three, 6-inch long by 2.5-inch diameter, thin-walled brass

sample liners); and

ASTM D 1785 Standard Specification for Polyvinyl Chloride (PVC) Plastic Pipe, Schedule 40, 80, and 120.

1.03 Location

The work will be conducted at 501 Ellis Street, Mountain View, California, shown in Figure D-1. Figure D-2 shows the locations of the proposed extraction wells to be constructed.

1.04 Access

- A. The Contractor shall provide his own means of moving and setting up equipment at each work site. The Contractor may use available existing public or private roads and shall be responsible for the maintenance and repairs of such roads to the conditions that existed immediately prior to start of use by the Contractor. Any fences that must be lowered for access shall be restored by the Contractor to the conditions that existed immediately prior to start of work.
- В. Physical access to the drill sites may be restricted due to existing facilities (buildings, fences, curbing, etc.) The Contractor is advised to make a reconnaissance visit to the site as early as possible before mobilizing and ascertain what provisions, if any, will have to be made to set-up on each of the work sites.

1.05 Safety and Health

- The Contractor shall certify in writing to Bechtel that all Contractor personnel who will perform work at the site have completed the necessary OSHA training and refresher and have had the proper medical surveillance for work at hazardous waste sites in accordance with the Code of Federal Regulations, Title 29, Part 1910.120, entitled "Hazardous Waste Operations and Emergency Response".
- В. The Contractor shall submit a Site Safety and Health Plan upon award of the Contract. The Contractor may fulfill this requirement by adopting, in writing, Bechtel's Site Health and Safety Plan.
- The Contractor shall identify one individual as the Health and Safety Contact C. for the Bechtel Safety and Health Officer (SHO). The Contractor's Safety and Health Contact shall be responsible for ensuring that all Contractor's

02230-2 **NEC 501 FSCGWRD** Rev.A, 8/26/96 nec \docsprog\specs\02230 doc

employees working at the site comply with the Site Health and Safety Plan and the directives of the Bechtel SHO. The Contractor shall provide all personal protective equipment, as specified in the Bechtel Site Health and Safety Plan for each Contractor employee working at the site. The Contractor shall ensure that all personal protective equipment are clean and in proper working order prior to the start of any work.

PART 2 PRODUCTS

2.01 Equipment Furnished By The Contractor

The Contractor shall provide and maintain all equipment, tools, parts, materials and supplies necessary to carry out the provisions of this Specification. The equipment shall be in good operating condition and capable of performing the required tasks safely and efficiently. The equipment shall be subject to inspection by the Engineer at all times and, when deemed unsatisfactory, shall be immediately repaired, or removed from the site and replaced with satisfactory equipment. No payment will be made for delays or time lost for equipment repairs or replacement.

A. Drilling Equipment

The Contractor shall provide all drilling equipment, drill tools and accessories necessary to obtain the boring diameter and depths by hollow stem auger drilling. The Contractor shall provide equipment and sealable leak-proof containers to capture and temporarily store and transport all drill cuttings and fluids ejected from the borings. The Contractor shall also provide equipment to contain and transport drill cuttings to a local landfill. The Contractor shall also have a bit plug available in case heaving sands are encountered.

B. Split-Spoon Soil Sampler

Soil samples shall be collected as specified by the Engineer using the 2.5-inch Modified California split-spoon sampler in accordance with ASTM D1586. The Contractor shall provide all soil sampling equipment and accessories needed for obtaining soil samples at depth intervals requested by the Engineer in all the borings. Soil sampling accessories shall include brass liners, equipment to remove samples and sample bags and labels. Sample catchers shall be made available and used as necessary to retain unconsolidated soils inside the split-spoons during sampling.

C. Decontamination Equipment

The Contractor shall provide a steam generator with appropriate accessories and personnel required to clean all equipment, tools, and materials that will come into contact with the subsurface. The Contractor shall also supply the equipment and materials required to wash any equipment in non-ionic detergent solution and to rinse them thoroughly in clean water.

NEC 501 FSCGWRD 02230-3
nec \(\text{nec \(\text{tocspring}\)\text{typecs\(\text{tocspring}\)\t

D. Equipment for Well Development

The Contractor shall supply a development rig, bailer, surge block, swab, submersible pump and generator or airlift pipe and compressor, and other materials and accesories needed for well development.

E. Aquifer Testing Equipment

Aguifer testing equipment to be provided by the Contractor shall include: a pump capable of pumping at rate ranging from 0.5 to 5 gallons per minute against a head of 50 feet, a flow meter measuring in gallons or tenths of cubic feet with a clock dial, a power supply to drive the pump, discharge hose and portable water tank, and other tools and equipment necessary for maintaining uninterrupted tests for a minimum of 4 hours.

F. **Equipment for Water Supply**

The Contractor shall provide the equipment needed to access water necessary to perform the work. The equipment required may include pumps, water trucks or trailers, hoses, storage tanks and all other items necessary to provide an adequate water supply. The source of the water will be the City water supply at 501 Ellis Street. All discharge water and wash water shall be contained and transferred by the Contractor to an on-site container supplied by Others. Any spills shall be contained and recovered.

2.02 Materials Furnished By The Contractor

Cement Α.

All cement used in the work shall conform to ASTM Standard C 150 for Type II Portland cement.

B. Bentonite

Bentonite shall be a high-swelling, sodium-based Wyoming-type bentonite. If it is supplied in powdered form, it shall be free-flowing. If it is supplied in pellet form, pellets shall be no greater than one-half inch in diameter and shall be free of moisture.

C. Riser Casing

Riser casing used for extraction wells shall be 6-inch nominal diameter, threaded, and flush-jointed schedule 40 polyvinyl chloride pipe in accordance with ASTM D 1785. Extraction well NEC1AE shall be stainless steel material and extraction well NEC27AE shall be rigid polyvinyl chloride (PVC). The casing shall be new, clean, straight and free of obstruction.

D. Screens

Screens shall consist of threaded, flush-jointed, 6-inch nominal diameter, Schedule 40, subject to approval by the Engineer prior to the beginning of field operations. The screen material for NEC1AE shall be stainless steel and

02230-4 **NEC 501 FSCGWRD** Rev.A, 8/26/96 nec \docsprog\specs\02230 doc

the screen for NEC27AE shall be PVC. The width of the slots shall be 0.020-inch. Screens shall be 15 feet inch length with a minimum open area of 1 square inch per foot of length. The bottom of the screen shall have a 2.5-foot sump with the bottom closed.

E. Filter Pack

Filter pack material shall be of a No. 3 Monterey Sand Specification or equivalent and shall be clean, well-sorted silica sand with less than 5 percent siliceous material. A sieve analysis shall be submitted by the Contractor for the Engineer's approval prior to the beginning of field operations.

F. Surface Casing Protection

Surface completion shall be in a flush mounted Christy box or equivalent with tamper proof, traffic-rated lid. The PVC casing shall be fitted with a protective cap that can be locked.

G. Plastic Sheeting

The Contractor shall provide plastic sheeting to keep clean samplers, tools, and materials from contacting the ground surface; to temporarily store drilling equipment; and to lay out boring soil cuttings for inspection by the Engineer.

H. Spill Control Materials

The Contractor shall provide absorbent padding for clean-up of accidental spills of gasoline or other non-aqueous fluids, and all other such items necessary to maintain the work area and equipment in a clean, safe, and orderly condition.

I. Waste Containers

The Contractor shall provide an adequate quantity of clean 55-gallon, non-leaking drums or similar containers for temporary containment of all drill cuttings, wash water, well development water and other waste that is produced at each work site.

2.03 Equipment And Materials Furnished By Others

Electronic data recording equipment (Hermit TM Data Logger).

PART 3 EXECUTION

3.01 General

All borings will be drilled using hollow stem augers. Soil samples will be collected using a modified California split-spoon core sampler. The groundwater table is approximately 12 to 16 feet below ground surface and soil conditions range from clay to gravely sand. Heaving sands may be encountered during drilling.

3.02 Personnel and Supervision

The Contractor shall provide an adequate number of qualified personnel to carry out the required tasks in a safe, efficient, and expeditious manner. A competent supervisor or foreman shall be designated and shall supervise the work process and serve as liaison between the Engineer and Contractor personnel. Rig and equipment operators shall be competent, experienced, and fully capable of performing to Specifications.

3.03 Drilling

A. Drilling Method

The drilling method shall be by hollow stem auger. The boring diameters shall be 12 inches or greater for installation of 6-inch diameter well casing. The drilling equipment shall be in good working condition and capable of securing satisfactory samples of the required diameter at a drilling depth of up to 35 feet.

The Contractor shall provide all necessary supplies for drilling, including all drill rods, bits, tools and end plugs for controlling any heaving sands. No organic drilling mud, solvents, organic joint compounds, or cleaning solution shall be introduced into the borings for any reason. Also, all drill cuttings shall be placed in 55-gallon drums or equivalent type of containers provided by the Contractor. The filled containers shall be transported to and emptied by the Contractor to a local municipal landfill as directed by the Engineer. Each boring shall be securely covered when left unattended and none will be left open overnight. The Contractor shall submit a description of equipment to be used with the bid.

B. Collection of Soil Samples

Subsurface soil samples shall be collected using a 2.5-inch diameter Modified California split-spoon sampler equipped with three 6-inch long brass liners. The Contractor shall provide brass liners for the split-spoon sampling. Three subsurface soil samples will be collected from each boring. Split spoon samples shall be collected according to ASTM D1586 procedures. At depths specified by the Engineer, the sampler with liners shall be inserted into the borehole and driven 18 inches or to refusal (equivalent to 6 inches penetration or less per 50 blows). Drive shoes shall be replaced or repaired when they become dented or distored. Samples collected in the brass liners shall be removed and placed in sample bags and appropriately labeled by the Contractor.

3.04 Extraction Well Design and Installation

The two soil borings will be completed as extraction wells. Figure D-3 is a typical extraction well design. All lengths and dimensions are approximate and may vary in accordance with field conditions.

NEC 501 FSCGWRD

nec \(\docsprog \specs\(02230 \) doc

Rev.A, \(8/26/96 \)

A. Installing Screen and Riser Casing

The final depth of the boring shall be measured by the Contractor with a weighted tape to ±0.1 foot. Sump and end cap shall be placed on the bottom of the screen. The screen and riser casing assembly shall then be lowered into the boring through the augers and suspended at the depth specified by the Engineer. Centering devices shall be placed on the assembly 1.5 feet above and below the screen. Any portion of the riser casing extending above ground surface that is cut off, shall be measured and reported to the Engineer.

B. Installing Filter Pack

Once the casing and screen are in place within the augers, clean water shall be pumped into the riser casing so that return flow will rise to the ground surface through the annular space, cleaning the hole of any drilling materials. The sand for the filter pack shall be poured into the annular space between the riser casing and auger/borehole. The auger shall be removed as the annular space is filled with filter pack. The filter pack shall extend from the bottom of the hole to at least 2 above the top of the screen. The final depth of the filter pack shall be determined by the Engineer. Depth to the filter pack will be continuously measured during placement.

C. Installing Seal and Backfill

After the filter pack is placed, bentonite pellets shall be inserted in the boring. After the pellets have reached the top of the filter pack, they shall be tamped in place using a rod, pipe or heavy weight attached to a rope. The minimum thickness of this bentonite seal, after tamping, shall be two feet. Following emplacement of the seal, the remainder of the annular space between the riser casing and sides of the borehole shall be filled with a cement/bentonite grout to the top of the hole. The grout shall be approximately in the following proportions: 6.5 gallons of water and 25 pounds of bentonite per sack of Type II cement. The grout shall be installed by placing rods, pipes, or a hose to a point immediately above the seal and pumping the grout into the boring until the grout reaches the surface.

D. Surface Completion

A utility vault, shall be installed at ground surface and over the PVC well casing as shown in Drawing M-003 in Appendix B of this Final Design. Each well shall be clearly marked for identification with a numbering system designated by the Engineer. An asphalt or black colored grout well pad will be constructed to slope slightly away from the hole to prevent ponding of water around the well.

3.05 Well Development

Following extraction well installation, each well will be developed. Development will not be initiated sooner than 24 hours following the completion of grouting. Development will proceed by bailing, surging with an airline and eductor, and/or

NEC 501 FSCGWRD 02230-7
nec \(\text{locsprog\specs\(\text{VO2230\) doc}} \)
Rev.A, \(8/26/96 \)

> pumping with a submersible pump. Surge blocks will be fitted with pressure relief valves. Under no circumstances will air be introduced directly into the well casing.

> Development will continue until the well produces clear water, or the water temperature, pH, and conductivity have stabilized as indicated by three consecutive measurements within 10 percent of each other. A minimum of 10 well volumes shall be removed from each well during development. Water characteristics will be monitored by the Engineer. Water removed from the wells during the development will be containerized and transferred by the Contractor to an onsite storage tank supplied by Others. It is anticipated that a groundwater sample will be collected by the Engineer at the completion of well development.

3.06 Acceptance Criteria

- All extraction wells shall be inspected by the Engineer at the completion of the well installation. The Engineer shall not accept the completed well if any one of the following conditions is observed: (1) broken sump/end cap, screen or riser casing, (2) the presence of grout, filter pack, or foreign material in the well casing, (3) failure to pass the alignment test, and (4) any other evidence that indicates unacceptable well construction.
- В. The alignment of the well shall be unacceptable if a straight, 15-foot length of minimum 5-inch O.D. PVC pipe cannot be passed freely down the length of riser casing to the top of the screen. This test shall be performed by the Contractor after completion of well development and shall be monitored by the Engineer.
- C. Following redevelopment of the proposed extraction wells step drawdown tests shall be conducted to determine well capacity and to establish a longterm pumping rate for the aquifer tests.

3.07 **Aquifer Test**

- A step drawdown test shall be conducted to establish a long-term pumping rate for the pumping test. It is expected to conduct 3-step test at rates ranging from 0.5 to 5 gallons per minute. Each step will run for two hours, or less. The pumping rates and duration will be determined by the Engineer.
- В. The pumping rates for each aquifer test shall be determined by the Engineer during well development. The tests aquifer shall not commence until at least 18 hours following all well development. Water levels in the wells shall be periodically monitored beginning prior to drilling to verify that levels have recovered sufficiently to conduct the aquifer test.
- C. The aquifer test shall be accomplished by pumping each extraction well at a pumping rate established during well development for 4-hours, or for a shorter time period as directed by the Engineer. Water levels in near by wells as identified by the Engineer, will be monitored during the pumping period and

02230-8 **NEC 501 FSCGWRD** Rev.A, 8/26/96 nec \docsprog\specs\02230 doc

> during the recovery period following cessation of pumping. The recovery test shall be conducted until the well is fully recovered or for 4-hours which ever comes first.

D. The Contractor shall furnish all necessary assistance and cooperation to the Engineer with regard to aquifer testing. Groundwater generated from the aquifer pumping test will be discharged to the City of Mountain View municipal sewer system. The Contractor shall provide the necessary equipment and labor to discharge water generated during the aquifer test directly to the sewer system. The Contractor shall furnish all necessary tools, equipment, and personnel to properly perform the aquifer tests required by the engineer.

3.08 Decontamination

- All drilling rigs, equipment, and tools including, but not limited to, augers, casing and bits shall be cleaned before work begins and between borings by first brushing away visible debris and then washing with a steam cleaner.
- В. Riser casing, screens, and end caps shall arrive on-set, clean and wrapped in plastic. All well installation and development equipment and supplies shall be washed with a steam cleaner before each use.
- C. Cleaned equipment will be stored on clean plastic sheeting in uncontaminated areas. A plastic cover shall also be used for the purpose of temporary storage of equipment in the work area. Materials to be stored more than a few hours, or as specified by the Engineer, will also be covered.
- D. All decontamination fluid shall be contained in leak proof, clean containers or a plastic-lined containment area.
- E. The work area shall be kept in neat and orderly condition at all times. Borings and wells shall be covered and secured when left unattended. completion of the work, the Contractor shall remove all rigs, surplus and unused materials and shall leave the area in a clean condition that is satisfactory to the Engineer.
- F. Fluids generated during the program, including drilling, well development, steam-generator waste run-off, and cleaning solutions/detergents, shall be collected in clean containers such as 55-gallon drums, or similar apparatus, temporarily stored and then discharged to the municipal sewer system as directed by the Engineer.
- G. All drill cuttings shall be placed in open-top 55-gallon drums or other appropriate containers and sealed with appropriate lids. Drums and lids shall be provided by the Contractor. Final disposition of the drill cuttings to a local

02230-9 **NEC 501 FSCGWRD** Rev.A, 8/26/96 nec \docsprog\specs\02230 doc

- municipal landfill designated by the Engineer (following receipt of analytical data) shall be the responsibility of the Contractor.
- H. The Contractor shall be responsible for disposal of all consumables and unused materials (e.g., PVC, sheeting, tyveks, etc.).

3.09 Reporting Requirements

A. The Contractor shall keep; and furnish to the Engineer, accurate driller's logs of each boring drilled. The logs shall show depth at which each change in material or stratification occurs and depths at which samples were obtained.

END OF SPECIFICATION NO. 02230

SPECIFICATION NO. 02831 CHAIN LINK FENCE AND GATE

PART 1 GENERAL

1.01 Summary

This Specification establishes the technical requirements for furnishing, delivering, and installing a complete chain link fence and gate. The chain link fence shall be complete with chain link fabric, framework, gates, fittings, and locks, as shown on the site-specific design drawings (Appendix B) and on the typical details and notes.

1.02 Codes and Standards

The fence and gate shall comply with the applicable American Society for Testing and Materials (ASTM) standards.

PART 2 PRODUCTS

2.01 Materials

Provide the following materials for the fence and gate:

- A. Chain link fence fabric shall be galvanized steel, galvanized after weaving, 2 inch mesh, 11 gage wire, 72 inch high, knuckled at one selvage and twisted at the other, ASTM A 392, Class 2 finish.
- B. Barbed wire shall be two strands galvanized steel 12 1/2 gage wire with four point barbs spaced not more the 5 inches on center. Galvanize in accordance with ASTM A 121, Class 3 finish
- C. Framework shall be galvanized steel standard weight pipe ASTM F 1083.
 - I. Corner Posts shall be 2.375 inch O.D. (2 inch NSP)
 - II. Line Posts shall be 1.9 inch O.D. (1 1/2 inch NSP)
 - III. Gate Posts shall be 2.875 inch O.D. (2 1/2 inch NSP)
 - IV. Top, Bottom and Brace Rails shall be 1.660 inch O.D. (1 1/4 inch NSP)
- D. Gates shall be of the swing type, in accordance with ASTM F 900. Fabricated from 1.90 inch O.D., Type I or II, galvanized steel pipe with welded or steel fitted corners. The fabric shall be as specified for the fence. Braces and trusses

shall be furnished. Latch shall be plunger bar type with padlock eye that permits operation from either side of the gate.

E. Slats (redwood or fiberglass) shall be installed diagonally in the chain link fence and gate to provide privacy.

All material is subject to testing. Mill certificates shall be submitted for approval upon request.

PART 3 EXECUTION

3.01 Installation

- A. Install fence to comply with ASTM F 567. Do not install fabric before the concrete foundation work is complete. Coordinate the fence post installation with the concrete curb placement by others.
- B. Center and align posts in the concrete curb at 3 inches above the bottom of the concrete. Verify that concrete placed by others around posts is vibrated or tamped for consolidation. Check each post for vertical and top alignment and hold in position during concrete placement and finishing operations.
- C. Apply fabric to outside of framework after receiving an approval for fabric installation. Leave approximately 2 inches between top of curb and bottom selvage.
- D. Gate: After repeated operations of completed installation equivalent to 3 days use by normal traffic, readjust gate and fence for proper alignment.

END OF SPECIFICATION NO. 02831

NEC 501 FSCGWRD
nec \(\text{docsprog\specs\02831\}\) doc

02831-2

Rev.A, 8/26/96

SPECIFICATION NO. 03300 CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 Summary

This specification establishes the technical requirements for furnishing labor, materials, appliances, tools, and equipment and performing all operations in connection with preparing, placing, and finishing of the concrete slab.

1.02 Codes and Standards:

The Contractor shall perform concrete operations in accordance with the applicable sections of the following:

- A. Uniform Building Code, 1994 (UBC)
- B. American Society for Testing and Materials (ASTM)
- C. American Concrete Institute (ACI)
- D. Concrete Reinforcing Steel Institute (CRSI)
- E. American National Standards Institute. (ANSI)

1.03 Requirements:

- A. All work shall comply with all pertinent Federal, state, and local requirements. All concrete and its placement shall conform to ACI 318-95 and ACI 301-89. All earthwork shall conform to UBC Chapter 18 and the requirements set forth in Site work (Specification No. 02200) and Site Preparation (Specification No. 02100).
- B. Contractor shall verify all existing conditions, dimensions and elevations and shall notify the Engineer of all exceptions before proceeding with the work.
- C. Where practical, Contractor shall make excavations as near as possible to the neat lines required by the size and shape of the structure. Contractor shall not excavate any unnecessary material. All foundations shall bear on firm and compacted soil.
- D. Concrete shall be machine mixed. The introduction of additional water after initial mixing will not be permitted. Slump shall be 4 inch maximum unless otherwise noted. The concrete mix shall include 1-1/2-inch, maximum aggregate size wherever clearance permits, and 3/4-inch maximum aggregate

size where it is necessary for proper placing. The temperature of the concrete at the time of placing shall not exceed 75°Fahrenheit. Concrete shall be made available by the Contractor for testing by the Engineer. A special inspection will be required per Chapter 17 of the UBC. The Contractor shall collect three test cylinders from each 100 cubic yards of concrete, or fraction thereof, placed each day. Test cylinders shall be made and stored in accordance with ASTM-C31. Contractor shall test the cylinders at 7 and 28 days. The third cylinder shall be used as a check cylinder when requested by the Engineer. Steel reinforcement laps shall be contact splices of 40 bar diameters and shall be staggered where possible.

- E. All concrete forms shall be clean and wetted. The Contractor shall not place concrete until all formwork has been secured in place, all items to be built into the concrete are in place, and the work has been inspected by the Engineer.
- F. The Contractor shall thoroughly and properly compact all concrete using approved mechanical vibrators, employed at each point of dump. Along the faces of forms, the Contractor shall use suitable tools during the pour to force large particles away from the forms and bring mortar to the surface of the forms. The Contractor is responsible for providing fully filled out, smooth, clean, and properly aligned surfaces free from pockets and blemishes.
- G. The Contractor shall finish the concrete slab to a tolerance of +/-0.5-inch, with the final elevations retaining the slope to drain shown in the drawings.
- H. The concrete will be allowed to cure a maximum of 48 hours between lifts and a minimum of 10 days before any equipment is placed or installed on the pad.

1.04 Submittals:

A. Before commencing with fabrication, the Contractor shall submit for approval a placement drawing. The drawing shall indicate elevations, main dimensions, connections and embeds.

PART 2 PRODUCTS

2.01 Concrete

- A. Concrete Design Mixes, ASTM C94, 28 Day Minimum Compressive Strength:
 - I. Slabs on Grade and Paving Base: 3000 psi.
 - II. Exterior Site Concrete and Pads Exposed to Weather: 3000 psi.
 - III. Lean Concrete Backfill: 2000 psi.

IV. Underground electrical or coaxial cable duct bank concrete encasement when shown on drawings: 2000 psi.

- B. Formwork: Plywood or metal panel formwork sufficient for structural and visual requirements.
 - I. Special forms for textured finish concrete.
 - II. Metal, plastic or paper tubes for cylindrical columns and supports.
- C. Reinforcing Materials:
 - I. Reinforcing Bars: ASTM A615, Grade 60, deformed.
 - II. Steel Wire: ASTM A82.
 - III. Steel Wire Fabric: ASTM A185, welded.
- D. Concrete Materials: ASTM C150, Type I, Portland cement; ASTM C33 normal weight aggregates; potable water.
- E. Concrete Admixtures: Containing less than 0.1 percent chloride ions.
 - I. Air-Entraining Admixture: ASTM C260, for exterior exposed concrete and foundations exposed to freeze-thaw shall contain from 4 to 7 percent total air.
 - II. Water-Reducing Admixture: ASTM C494, Type A, for placement and workability.
 - III. Water-Reducing, Accelerating Admixture: ASTM C494, Type E, for placement and workability.
 - IV. Water-Reducing, Retarding Admixture: ASTM C494, Type D, for placement and workability.
- F. Auxiliary Materials:
 - I. Reglets: Galvanized sheet steel reglets, minimum 26 gage.
 - II. Waterstops when shown on drawings: Rubber or PVC waterstops.
 - III. Vapor Retarder: ASTM E154 polyethylene sheet, 8 mils.
 - IV. Vapor Barrier: Premolded membrane, ASTM E96, Method B, zero vapor transmission rate.

NEC 501 FSCGWRD

nec \(\text{locsprog} \text{lspecs} \text{03300-3} \\
Rev.A, \(8/26/96 \)

Specifications Appendix D

> Nonslip Aggregate Finish when shown on drawings: Fused aluminum oxide granules or crushed emery.

- VI. Liquid Membrane-Forming Curing Compound: ASTM C309, Type 1, Class A.
- VII. Water-Based Acrylic Membrane Curing Compound: ASTM C309, Type 1, Class B.
- Monomolecular VIII. Evaporation Control Compound: film-forming compound.
- IX. Underlayment Compound: Free-flowing, self-leveling cement-based compound.
- X. Bonding Compound: Polyvinyl acetate or acrylic base.
- XI. Epoxy Adhesive: ASTM C81, two-component material.
- XII. Dry Pack Cement Grout: 2 parts sand to 1 part cement.
- G. Embedded and Miscellaneous Steel:
 - I. Anchor Bolts: Headed A307 Grade B, Non Headed A307 Grade C
 - II. Anchor Plates: ASTM A36
 - III. Nuts: ASTM A563 Standard Heavy Semi-Finished Hexagonal
 - IV. Threads: UNC per ANSI B1.1 Class 2 FIT
 - V. Washers: ASTM F436
 - VI. Embedded Angles: ASTM A36
 - VII. Galvanized Coatings: Per ASTM A153
 - VIII. Steel Floor Grating and Banding: ASTM A36, Merchant Grade, 1 1/4 in. grating, 1 1/4 in. x 3/16 in. bearing bars at 1 3/16 in. center to center, with cross bars with minimum 1/8 square inch cross sectional area spaced at 4 in, center to center.
 - Welding Studs: Nelson Studs, Type S3 (with ferrules) or approved equal per ASTM A108.

03300-4 **NEC 501 FSCGWRD** Rev.A, 8/26/96 nec \docsprog\specs\03300 doc

PART 3 EXECUTION

3.01 General:

- A. Concrete finishes for formed surfaces:
 - I. Surfaces not exposed to view: As-cast form finish.
 - II. Surfaces exposed to view: Smooth form finish.
- B. Concrete finishes for monolithic slabs or as shown on site-specific drawings:
 - I. Scratch finish for surfaces to receive concrete floor topping or mortar setting bed.
 - II. Trowel finish for surfaces to be exposed to view or covered with resilient flooring, carpet, tile, or other thin finish system.
 - III. Nonslip broom finish for exterior concrete platforms, steps, and ramps.

3.02 Quality Assurance

- A. Standards: ACI 318, Building Code Requirements for Reinforced Concrete, and CRSI Manual of Standard Practice.
- B. Testing: Independent testing laboratory when required by Contractor or by local jurisdictions. Concrete compressive strengths to be provided from ready mix supplier standard mix design and verified by batch plant ticket from delivery truck.
- C. Special Inspections: As required by local jurisdictions.

END OF SPECIFICATION NO. 03300

SPECIFICATION NO. 05510 CANOPY

PART 1 GENERAL

1.01 Summary

This Specification establishes the technical requirements for a canopy over the groundwater treatment plant.

1.02 Scope Of Work

- A The shelter and or roof cover structure shall have no walls; its primary function is to protect equipment from direct exposure to the sun and rain. The roof shall be shed type and shall extend beyond the edges of the groundwater treatment plant. The clear height at the eaves shall be 9 ft.
- B. The structure shall be either braced or rigid steel frame type. Knee braces in either direction are acceptable. The bottom of the knee braces shall not extend more than 2 feet below the clear height at the eaves. For braced frames cross bracing shall be on the sides and at the end elevations of the structure.
- C. The roof shall be supported by columns spaced as required by UBC. Columns shall bear on and be anchored to the equipment slab.
- D. The roof slope shall be as shown on the drawings, Appendix B. Gutters and down spouts are not required.
- E. All structural steel shall receive at least one coat of primer and all surfaces exposed to view after erection shall be finished painted.

1.03 Codes and Standards

A. UBC (Uniform Building Code) 1994, AISC (American Institute of Steel Constructors) and AWS (American Welding Society) shall be followed for design, fabrication, and erection of the structure. For design of the drilled anchors at column bases, the 28 day compressive strength (f'c) of the concrete slab shall be assumed as 3000 psi.

1.04 Submittals

A. Before commencing with fabrication, the Contractor shall submit for approval framing drawing(s) and calculations. The drawing(s) shall indicate elevations, main dimensions, and connections at the column bases.

B. Paint colors shall be submitted to the Engineer for approval.

PART 2 PRODUCTS

2.01 Roof Materials:

A. Roofing shall be corrugated or otherwise ribbed. The following are acceptable as roofing material:

Galvanized steel sheets Aluminum sheets Opaque plastic sheets.

2.02 Support Structure:

A. Purlins, sag rods, roof beams, eaves struts, knee braces, and columns shall be steel. Any of the following materials are acceptable:

Hot-rolled structural shapes and plate, ASTM (American Society of Testing Materials) A36 or better
Tubing or pipe, ASTM A500 or A501 or A53.
Cold formed members, ASTM 607
Bolts shall be ASTM A307 or A325

2.03 Fabrication:

A. Shop connections shall be welded or bolted.

PART 3 EXECUTION

3.01 General:

- A. Field connections shall be bolted so that the structure may be disassembled without difficulty.
- B. After erection, damaged primer paint shall be touched up, and all exposed surfaces shall be finish painted.

END OF SPECIFICATION NO. 05510

SPECIFICATION NO. 11325 GROUNDWATER TREATMENT EQUIPMENT

PART 1 GENERAL

1.01 Summary

A. Supplier shall provide groundwater treatment equipment (cartridge filter and activated carbon adsorbers) suitable for outdoor operation. The cartridge filter and activated carbon adsorbers shall operate intermittently. The groundwater treatment equipment shall be complete units including, but not limited to, external connections, internal piping, cartridges, and activated carbon necessary to operate the units.

1.02 System Description

- A. The water treatment equipment shall treat groundwater withdrawn from three extraction wells. Groundwater from the three extraction wells shall be pumped to a holding tank and a carbon adsorber feed pump, through the cartridge filter and activated carbon adsorbers into a sanitary sewer. The sanitary sewer connects to the City of Mountain View's publicly owned treatment works.
- B. Groundwater from the holding tank shall be pumped through the cartridge filter and three activated carbon adsorbers, in series. The cartridge filter shall remove suspended solids that remain is solution following an in-line Y-strainer at the well head. The activated carbon adsorbers shall remove volatile organic compounds (VOCs) from the groundwater.

PART 2 PRODUCTS

2.01 Groundwater Treatment Equipment

A. Equipment included in this section are a cartridge filter and activated carbon adsorbers.

2.02 Cartridge Filter (CF-201)

A. Influent groundwater characteristics to the cartridge filter are expected to be as follows:

Calcium	250 mg/L, - average
Magnesium	76 mg/L, - average
Sodium	34 mg/L, - average
Iron	3.4 mg/L, - average
Sulfate	518 mg/L, - average

Chloride Temperature 55 mg/L, - average 50° F to 70° F

- B. The cartridges in the cartridge filters shall have 20 micron openings.
- C. The cartridge filter shall be a single unit that will comply with the following:

Flow

10 gpm - design

Pressure Rating

150 psi

Tank

304 Stainless Steel with support legs

Lid

Multiple wing nuts for closure

Holding rods, lifter

CPVC

and pipe caps

O-rings, seals

Buna-n o-rings, EPDM rim gaskets

and gaskets

and top seals

Cartridge Replacement

Cluster (all cartridges at once)

Vent

None

- 2.03 Activated Carbon Adsorption System (GAC-201)
 - A. The activated carbon adsorption system shall consist of three replaceable canisters.
 - B. Groundwater characteristics to the activated carbon adsorbers are expected to be the following:

Flow

10 gpm - design

Trichloroethene (TCE).

720 μg/L, - average

VOC

1,620 μg/L, - maximum 770 μg/L, - average

1 600 ug/ī

1,690 μg/L,

Temperature $50^{\circ} \text{F to } 70^{\circ} \text{F}$

C. Effluent concentration from the activated carbon adsorbers shall meet the following concentration:

TCE

 $< 5 \mu g/L$,

- average

- maximum

- D. The activated carbon adsorbers shall operate in series. Any adsorber will be capable of being the lead, middle, or lag canister.
- E. An activated carbon adsorption system canister shall comply with the following:

Pressure

15 psig, maximum

Material

Carbon steel

Diameter

24 inches, nominal

Height

34 and 1/2 inches, nominal

Volume

55 gallons

Carbon per Canister

160 lb. of activated carbon, Filtrasorb 300,

minimum

Operation Mode

Downflow fixed bed.

Carbon Regeneration

Canisters to be returned to supplier for

regeneration.

PART 3 EXECUTION

3.01 Installation

- A. Equipment shall be installed outdoors in accordance with manufacturer's instructions.
- B. Provide access space around equipment to service the equipment. Provide at least the minimum space recommended by the manufacturer.
- C. Pipe drains shall discharge into a sump.

3.02 Testing

- A. System shall be tested to assure proper operation. Testing shall be performed in accordance with the manufacturer's standard procedures.
- B. Ensure that all components operate in parallel or series at specified system fluid temperatures and pressures, are non-overloading, and meets the specified effluent concentrations.

END OF SPECIFICATION NO. 11325

SPECIFICATION NO. 15010 GENERAL MECHANICAL REQUIREMENTS

PART 1 GENERAL

1.01 Summary

- A It is the intention of the Design Package, including Specifications and Drawings, to provide the Remedial Action Contractor (RAC) with the information necessary to understand the system requirements and to identify, procure, and to install the mechanical equipment required to remediate groundwater at the NEC Ellis Street site. The Design Package identifies the requirements for equipment and instrumentation and describes the basic processes of operation and control but does not detail all aspects of design, construction and commissioning. It is the responsibility of the RAC to completely install and connect system equipment and components in accordance with the parameters of the Design Package, good industrial practices, and the requirements or intent of the Design Package shall be brought to the attention of the Engineer for review.
- B. Drawings are diagrammatic and are intended to convey scope of work and to indicate general arrangement. They are not intended to show all details, such as offset, fittings, or structural elements that may be required. Except as otherwise indicated, locations of items are approximate only. Exact locations necessary to secure proper conditions and results must be determined at Project Site and are the responsibility of the RAC. Do not scale drawings.
- C. Except as otherwise indicated, reasonable modifications in layout may be made to prevent conflicts and to ensure proper access and installation.

1.02 Regulatory Requirements

- A. Conform to applicable Local Codes.
- B. Mechanical: Conform to Uniform Mechanical Code as adopted by local authority.
- C. Plumbing: Conform to Uniform Plumbing Code as adopted by local authority.
- D. Obtain permits, and request inspections from authority having jurisdiction.

1.03 Quality Assurance

A. Comply with provisions of ASME B31 Series "Code for Pressure Piping."

> В. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

> C. Equipment Selection: Equipment of greater or larger power, dimensions, capacities, and ratings may be furnished provided such proposed equipment has the concurrence of the Engineer and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased as required. In addition to any minimum energy ratings or efficiencies specified for equipment, the equipment must meet the design requirements and commissioning requirements.

1.04 Delivery, Storage, And Handling

- Deliver equipment and components well-sealed, equipment with nozzles covered or blind-flanged, pipes and tubes with factory-applied end-caps. Maintain caps through shipping, storage, and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture.
- В. Protect stored equipment and material from moisture and dirt. Elevate above grade.
- C. Protect flanges, fittings, and piping specialties from moisture, dirt and damage.
- D. Support piping to minimize sagging and bending.

1.05 Codes and Standards

The applicable sections of the following codes and standards shall be used:

American National Standards Institute (ANSI) American Petroleum Institute (API) Anti-Friction Bearing Manufacturers Association (AFBMA) American Society of Mechanical Engineers (ASME) American Welding Society (AWS) Occupational Safety Health Administration (OSHA)

PART 2 **PRODUCTS**

2.01 Materials And Equipment

Provide standard products of a manufacturer regularly engaged in the manufacture of the indicated products. Where more than one unit is required of any product, provide products by the same manufacturer, except where otherwise indicated. Provide products recommended by the manufacturer for use in the service indicated. In the event of a conflict between plans and specifications and the manufacturer's recommendations, notify the Engineer.

15010-2 **NEC 501 FSCGWRD** Rev. A, 8/26/96 nec \docsprog\specs\15010 doc

2.02 Liquid Transfer Pumps

- A. Provide all materials, components, accessories, start-up spares and services for the design, fabrication, inspection, and testing of the pumps. Unless specifically noted otherwise either in this specification or in the attached data sheets, the pumps, drivers and accessories shall be in accordance with applicable API and/or ANSI/ASME standards.
- B. Each pump assembly shall be furnished complete with its own driver and all accessories installed by the Supplier and ready for operation.

C. Design Conditions and General Requirements

I. General

- a. Materials of construction shall be suitable for the pumped fluid...
- b. For horizontal centrifugal pumps, the pump operating characteristics at normal flow conditions shall be near the point left of maximum efficiency on the pump performance curves.
- c. The NPSHR requirements shall be based on water. The NPSHA shall exceed the NPSHR by at least three (3) feet from minimum continuous flow to 110% of flow at the rated operating point.
- d. Pumps and drivers, when operating at rated conditions, shall not exceed a noise level of 85 dBA at 3 feet when measured any direction from the pump baseplate. The Seller shall state what the predicted noise level is for each pump and driver.

II. Pump Construction

- a. All casings, bearing housings, and stuffing boxes shall be provided with tapped and plugged vent and drain connections.
- b. For flanges in the vertical plane, the bolt holes shall straddle the vertical and horizontal center lines.
- c. Casings shall be free from cracks, pits, or nodules.

III. Impellers

a. If an impeller is provided, the type of impeller shall be suitable for the service indicated.

IV. Bearings

a. All pump drive anti-friction bearings shall be in accordance with AFBMA.

15010-3

Rev. A, 8/26/96

b. Bearings shall be either oil or grease lubricated. If the pump bearings are oil lubricated, a constant-level oiler shall be provided for each bearing housing.

V. Mechanical Seals

Mechanical seals shall be provided and installed together with all a. necessary accessories in accordance with API 610.

D. Accessories

I. **Baseplate**

For above-ground pumps, the Seller shall furnish a common a. baseplate that accommodates the pump, driver and all other Seller provided accessories. The driver and accessories shall be assembled, aligned, and leveled on the baseplate. A 0.75-inch NPT drain connection shall be provided at the pump end.

II. Couplings and Guards

- For above-ground service, Thomas couplings shall be provided and shall have a service factor of at least 2.0.
- Removable coupling guards shall be provided and shall comply b. with 1910 of OSHA regulations.

III. **Auxiliary Piping**

All tubing provided, if required, shall be stainless steel, 0.75-inch a. outer diameter and shall have a wall thickness of at least 0.035 inches.

2.03 Spare Parts And Special Tools

- As a minimum, it is recommended that the following spare parts be acquired with original equipment and maintained in onsite inventory:
 - I) Spare pilot light lamps of each type used on the project, in quantity of ten percent, but not less than two.
 - II) One year's supply of expendable parts including oil, grease, belts and filters.
- Special Tools: If any part of equipment furnished under these Specifications В. requires a special tool for assembly, adjustment, setting or maintenance and such tool is not readily available, such special tools should be acquired with equipment as a standard accessory.

NEC 501 FSCGWRD 15010-4 Rev. A, 8/26/96 nec \docsprog\specs\15010 doc

PART 3 EXECUTION

3.01 General

A. Excavation and Backfilling: Bury piping to a depth of not less than 1'-6" below finish grade unless otherwise indicated. Ensure that sand backfill completely surrounds the pipe a minimum of 3 inches in all directions.

В. Paint unpainted equipment, fixtures, hangers, supports, and accessories with one coat of primer and one coat of latex based paint, color to be selected by the Engineer.

3.02 **Equipment And Piping Installation**

- Except where otherwise indicated, install equipment level and plumb, parallel and perpendicular to other components.
- В. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment to allow for ease of disconnection with minimum of interference with other installations. Extend grease fittings to an accessible location.
- C. Install equipment giving right-of-way to piping systems installed at a required slope for drainage.
- D. Unless otherwise indicated, provide housekeeping pads of concrete, a minimum thick and extending 6 inches beyond the edges of supported 4 inches equipment.
- E. Construct supports of steel members or steel pipe and fittings. Brace and fasten with flanges bolted to structure.
- F. Provide rigid anchors for pipes after vibration isolation components are installed.
- Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
- H. Field Welding: Comply with AWS D1.1 "Structural Welding Code - Steel."
- T. Cut, fit, and place anchorages to support and anchor mechanical materials and equipment.

15010-5 Rev A, 8/26/96 nec \docsprog\specs\15010 doc

Appendix D

- J. Select fastener sizes that will not penetrate members where the opposite side will be exposed to view or will receive finish materials. Make tight connections between members.
- K. Attach to substrates as required to support applied loads.
- L. Install nonmetallic nonshrink grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's printed instructions.
- M. Clean surfaces that will come into contact with grout. Provide forms for placement of grout, as required. Avoid air entrapment when placing grout. Place grout to completely fill equipment bases. Place grout on concrete bases to provide a smooth bearing surface for equipment. Place grout around anchors. Cure placed grout according to manufacturer's printed instructions.

3.03 Tests And Adjustments

- Test systems as specified under applicable Sections of these specifications, as determined by the authority having jurisdiction, and within the time specified.
- Drain water used for testing from the system after tests are complete.

3.04 **Protection And Cleaning**

- During the course of construction, cap all pipe and electrical conduit in a manner that ensures adequate protection against entrance of dirt and debris, cap all lines and equipment nozzles so as to prevent the entrance of debris and dirt. Protect equipment against moisture, plaster, cement, paint and other work by covering it with polyethylene sheets.
- В. Cleaning: After installation has been completed, clean systems as follows:
 - I) Piping and Equipment to be Painted: Clean exterior of piping and equipment exposed in completed structure, and remove rust, plaster, cement, dirt, grease, oil and similar materials.
 - II) Motors, pumps and other items with factory finish: Remove grease and oil, and leave surfaces clean and polished.

3.05 Related Electrical Work

- Ensure that manufactured mechanical equipment is configured without the need for connection to more than one power source.
- В. Plumbing and mechanical piping shall not be run above electrical equipment. Clearance shall be provided on all sides of equipment.

15010-6 Rev. A, 8/26/96 nec \docsprog\specs\15010 doc

SPECIFICATION NO. 15410 PIPING AND VALVE MATERIAL AND INSTALLATION

PART 1 **GENERAL**

1.01 **Summary**

This specification establishes the technical requirements for furnishing, delivering and installing aboveground and underground piping.

1.02 Scope Of Work

- The following work is included: Α.
 - I. Design and specification of piping, fittings and valves to meet the requirements of this specification and the ASME B31.3 code.
 - II. Purchasing material, components, instruments, and equipment
 - III. Furnishing pipe, fittings, and valves in accordance with the drawings and this specification
 - IV. Furnishing bolts, stud-bolts, nuts, and gaskets.
 - V. Furnishing orifice flanges, blind flanges, special flanges, instruments, startup strainers, filters, valve boxes, blanks and spacers for hydrostatic testing, cleaning and system flushing, where shown on the drawings.
 - VI. Coating bolts, stud-bolts, and nuts for underground service in accordance with this specification.
 - VII. Furnishing additional miscellaneous items as needed for the installation and system testing.
 - VIII. Furnishing and installing pipe supports for aboveground piping, as required to support the piping.
 - IX. Fabricating and installing integral structural attachments.
 - X. Performing system and pressure testing and examinations.
 - XI. Cleaning and flushing piping system

15410-1 Rev.B, 8/26/96 nec \docsprog\specs\15410 doc

1.03 Codes and Standards

A. The following codes and standards form an integral part of this specification. The latest issue of these standards and codes shall be used, including case rulings, interpretations, and published addenda, as applicable at the initial date of issue of this specification.

American Society Of Mechanical Engineers (ASME)

ASME B31.3

Chemical Plant and Petroleum

Refinery Piping

UNI-BELL

Uni-Bell Handbook of PVC Pipe Design and Construction

American Society For Testing And Materials (ASTM)

ASTM D1785	Poly (Vinyl Chloride) (PVC) Plastic Pipe Schedules 40, 80, and 120
ASTM D2467	Socket - Type Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D2564	Solvent Cements Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings
ASTM D3350	Polyethylene Plastics Pipe and Fittings Material
ASTM A307	Carbon Steel Bolts and Studs, 60,000 psi Tensile
ASTM A563	Carbon and Alloy Steel Nuts
ASTM D1784	Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
ASTM F441	Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Schedules 40 and 80
ASTM F439	Socket - Type Chlorinated Poly (Vinyl Chloride) CPVC Plastic Pipe Fittings, Schedule 80

1.04 Drawing

- A. A piping and instrument diagram (P&ID) is furnished which shows the necessary process interconnections, line sizes and piping classes for elements of the process piping system. The piping system includes all piping, branch connections, flanges, valve and equipment identification and locations, bypasses, instrument points, vents, drains, and connections to equipment.
- B. Area drawings are furnished to show dimensions as necessary to locate major pieces of equipment and to approximately route the piping system.

1.05 Shipping, Storage and Handling

A. General

- I. The contractor shall be responsible for the delivery of all materials to the jobsite undamaged and in usable condition.
- II. Piping, fittings, and valves shall be adequately blocked, strapped, or otherwise held in position during shipment and shall be further separated by dunnage as necessary to prevent damage.
- III. Small loose pieces, including bolting and gaskets, shall be boxed for protection during shipment, where not installed at the factory.

B. Storage of Materials

- I. Piping, tubing, components and equipment shall be stored where they are protected from the elements, preferably inside buildings. Outside storage shall be in well-drained areas, elevated above the ground, and covered with durable, opaque, waterproof covering in inclement weather or when stored for extended periods of time.
- II. Gaskets shall be protected from excessive heat, direct sunlight, oil, grease, and all other materials or conditions which may contaminate and/or degrade the gasket material.
- III. Loose fittings, valves and equipment shall be either packaged inside waterproof material, or tightly sealed at the ends to prevent damage and the entrance of dirt and moisture.
- IV. Solvent cement shall be stored in tightly sealed containers away from excessive heat.

PART 2 **PRODUCTS**

2.01 Piping, Fittings and Valves

POLYVINYL CHLORIDE (PVC) PIPE

Except as otherwise specified herein, or as called for in the Final Design PVC pipe and fittings shall conform to the following requirements.

- I. Piping shall be Schedule 80. All PVC pipe shall conform to the requirements of ASTM D-1785, Type 1 (normal impact), grade 1 (high chemical resistance and shall be solvent welded.
- All fittings shall conform to ASTM D2467 (schedule 80) standards to II. match the piping and shall be socket type for solvent cement welding. Contractor shall perform solvent welding in accordance with the manufacturer's specifications.
- III. All flanges shall be Polyvinyl Chloride, PVC, ASTM D1784, Schedule 80, Socket - type solvent cemented joints, flat faced, dimensioned and drilled to ANSI B16.5 class 150#. Gaskets and bolting shall be suitable for the service conditions.
- IV. Ball and check valves shall be True Union Socket ends, 150# working pressure rating, ASTM D1784 PVC body. Gate and globe valves shall be socket ends, 150# working pressure rating, ASTM D1784 PVC body.

В. HIGH DENSITY POLYETHYLENE (HDPE) PIPE

- I. Except as otherwise specified herein, or as called for in the Plans, HDPE pipe and fittings shall conform to the following requirements.
- Piping shall be SDR 32.5 (minimum) thickness. All HDPE pipe shall II. conform to the requirements of ASTM D-3350 cell classification 345434C and shall be butt fusion welded.
- III. All fittings shall conform to ASTM D-3350 standards and shall be butt fusion welding type. Contractor shall perform fusion welding in accordance with the manufacturer's specifications.
- IV. The piping between the extraction wells and the treatment plant shall be a dual containment HDPE system. The sizes of the process pipe and the associated containment pipe are to be as shown on the drawings.

NEC 501 FSCGWRD 15410-4 Rev.B, 8/26/96 nec \docsprog\specs\15410 doc

> V. All flanges shall be HDPE stub ends with backing flanges drilled to ANSI B16.5 class 150#. Gaskets and bolting shall be suitable for the service conditions.

> VI. Valves in the HDPE piping at the treatment plant shall be shall be flanged ends drilled to ANSI B16.5 class 150# except as specified otherwise on the drawings

C. DUAL CONTAINMENT SYSTEM (DCS) HDPE PIPING

- I. Except as otherwise specified herein, or as called for in the Plans, DCS pipe and fittings shall conform to the following requirements.
- II. Piping shall be SDR 32.5 (minimum) thickness for both the carrier and All DCS HDPE pipe shall conform to the containment pipes. requirements of ASTM D-3350 cell classification 345434C and shall be butt fusion welded according to the manufacturer's specifications
- III. All fittings shall conform to ASTM D-3350 standards and shall be butt fusion welding type. Contractor shall perform fusion welding in accordance with the manufacturer's specifications.
- The DCS HDPE piping system shall be rated for the carrier pipe pressures and temperatures.
- V. All flanges shall be HDPE stub ends with backing flanges drilled to ANSI B16.5 class 150#. Gaskets and bolting shall be suitable for the service conditions.
- Carrier and containment pipe sizes shall be as specified on the project drawings. The first dimension in the line number is the carrier pipe diameter, the second dimension is the containment pipe diameter.
- VII. The containment pipe shall be sealed at the extraction wells and open at the treatment plant.
- VIII. The carrier pipe shall be supported within the containment pipe according to the manufacturer's recommendations.

D. CHLORINATED POLYVINYL CHLORIDE (CPVC) PIPE

Except as otherwise specified herein, or as called for in the Final Design CPVC pipe and fittings shall conform to the following requirements.

NEC 501 FSCGWRD 15410-5 Rev.B, 8/26/96 Appendix D

- I. Piping shall be Schedule 80. All CPVC pipe shall conform to the requirements of ASTM F441 and shall be solvent welded.
- II. All fittings shall conform to ASTM F439 (schedule 80) standards to match the piping and shall be socket type for solvent cement welding. Contractor shall perform solvent welding in accordance with the manufacturer's specifications.
- III. All flanges shall be Chlorinated Polyvinyl Chloride, CPVC, ASTM D1784, Schedule 80, Socket - type solvent cemented joints, flat faced, dimensioned and drilled to ANSI B16.5 class 150#. Gaskets and bolting shall be suitable for the service conditions.
- IV. Ball and check valves shall be True Union Socket ends, 150# working pressure rating, ASTM D1784 CPVC body. Gate and globe valves shall be socket ends, 150# working pressure rating, ASTM D1784 CPVC body.

PART 3 **EXECUTION**

3.01 General

- All materials, fabrication, assembly, installation, inspection, and testing of Α. tubular products and fittings and the piping systems within the scope of this specification shall be of new material and in accordance with the referenced standards. Materials shall meet the requirements of the ASTM specifications, ASME/ANSI standards, and codes as identified herein. Material substitutions. other than those specifically identified, shall be made only with the concurrence of the Engineer.
- В. Before excavation, locate existing underground utilities using metal detectors and drawings. All trenching shall conform to OSHA regulations.
- C. Underground piping shall be installed, inspected, and tested in accordance with the requirements of ASME B31.3.
- D. After installation is complete, restore surfaces affected by the installation to original conditions.
- E. Any apparent conflict between this specification and the requirements of the standards shall be brought to the attention of the Engineer; in general, the more stringent requirement shall be met. Nothing in this specification shall be interpreted as in any way relieving the RAC of the responsibility for complete compliance with the standards.

NEC 501 FSCGWRD

Rev.B, 8/26/96

F. Any PVC or CPVC fittings which are exposed to sunlight and are not UV-protected shall be painted with a minimum one coat of opaque latex paint, color to be selected by the RAC.

3.02 Inspection and Examination

A. Inspection and examination shall be in accordance with the requirements of the listed standards and this specification. In the case of a conflict between the standards and this specification, the more stringent requirement shall be met. Any such conflicts shall be brought to the attention of the Engineer.

3.03 Erection

A. General

- I. Care shall be exercised in the storage and handling of all piping materials and fabricated subassemblies to prevent contamination by grease, moisture or other foreign matter, and to prevent damage. End covers, where furnished, shall not be removed until necessary for fabrication or erection.
- II. All piping shall be installed without cold springing or forcing the piping into position. Alignment shall meet the manufacturer's requirements. Cutting or weakening of structural members to facilitate piping installation shall not be permitted.
- III. Where any piping must be routed across traffic lanes, provisions shall be made to protect the piping from damage.
- B. Installation in Trenches Exercise caution during trench backfill to prevent piping installed in casings from floating out of position. Wedges shall not be used to lock the piping into position.
- C. Equipment Connections Piping connections to equipment, vessels, and machinery shall conform to the details shown on the drawings and to the requirements of this specification. Connections shall match sizes and types of actual equipment purchased.

3.04 Support and Anchors

- A. Threaded Connections Where threaded connections are used, support assembly components shall have thread engagement of more than two full threads. The amount of thread engaged and available for further adjustment shall be plainly in view. Other than spring can adjustments, locknuts or staking of threads shall be used for threaded connections to prevent thread disengagement. Sight holes shall be provided where necessary.
- B. Attachments to Concrete Concrete fasteners shall be appropriate to the load and configuration of the attachment.

NEC 501 FSCGWRD

15410-7

nec \(\text{ldocsprog\specs\\ 15410\doc} \)

Rev.B, \(8/26/96 \)

3.05 Testing

A. Testing of piping shall be performed in accordance with the requirements of ASME B31.3.

END OF SPECIFICATION NO. 15410

SPECIFICATION NO. 15976 LOCAL CONTROL PANELS

PART 1 GENERAL

1.01 General Requirements

- A. This specification covers the furnishing of all labor, materials and services in connection with the design, fabrication and delivery of local control panels.
- B. The panels shall be furnished in conformance with this specification. When conflicts arise between this specification and any referenced document, they must be resolved by the Buyer in writing.
- C. The Seller shall furnish the panels ready for installation with all work completed. All instruments and other devices, whether furnished by the Buyer or the Seller, shall be installed, wired and/or piped as specified herein and in the referenced documents. The Seller shall furnish all miscellaneous items required for a complete assembly.
- D. The Buyer shall furnish required panel general arrangement drawings, loop diagrams, and panel wiring diagrams for the Seller's use.

1.02 Submittals

- A. The Seller shall furnish drawings as follows:
 - I. Dimensional drawings of panels with cutouts.
 - II. As-built panel wiring diagram.
 - III. Operating Manuals and catalog information including maintenance instructions for each type of device.
 - IV. Test procedures per section 3.03.
 - V. Test reports per section 3.03.

1.03 Codes and Standards

A. All systems and devices shall conform to applicable standards (latest editions) of the following institutes, societies and associations:

ANSI American National Standards Institute, Inc.

ISA Instrument Society of America

NEC National Electrical Code of National Fire Protection

Association (NFPA)

NEMA National Electrical Manufacturer's Association

UL Underwriter's Laboratories, Inc.

IEEE Institute of Electrical and Electronic Engineers

1.04 Crating and Shipping

A. Panels shall be properly crated and braced to provide protection against damage to structure, instruments, or finish during transit by motor freight and handling.

B. The Seller shall remove and properly pack all plug-in instruments and devices to prevent damage during transit and handling. Further, any other equipment which cannot be properly secured for transit and handling shall be removed and adequately packed.

PART 2 PRODUCTS

2.01 Design and Construction

A. The panels shall be completed wired and assembled, with all instruments, controls, and associated devices installed in the panel so that the entire assembly is an operating unit ready for installation. The instruments and control devices shall be wired in accordance with the drawings. The panels and component parts described herein shall conform in all respects to the highest standards of design and workmanship and applicable requirements of the latest edition or revision of the Codes and Standards listed in section 1.03 and other applicable federal, state or local codes. All accessories, not herein specified or mentioned but required to complete the control panel, shall be supplied by the Seller.

2.02 Cabinet Construction

- A. Enclosures shall be provided in accordance with the panel drawings, including subpanels and associated hardware.
- B. Wire entry shall be through the bottom of the cabinet.
- C. Unless specified otherwise, enclosures shall be standard prefabricated NEMA 3R enclosures with a full length, continuous door hinge as manufactured by Hoffman Engineering or equal.

2.03 Nameplates

A. Nameplates for all panel mounted instruments, switches, relays, converters, etc., shall be provided by the Seller. Type and size of lettering shall be as specified on the Buyer's drawings list. Nameplates for all interior mounted instruments shall list tag number.

NEC 501 FSCGWRD

15976-2

nec \docsprog\specs\15976 doc

Rev.A, 8/26/96

B. Exterior nameplates shall be attached with screws as specified on the panel general arrangement drawings.

C. All front or rear panel mounted devices to which a device number is assigned on the Buyer's drawings shall have a nameplate bearing the number attached on or adjacent to the device case.

2.04 Terminal Blocks

- A. Terminal blocks shall be Phoenix type MTK-P/P or approved equal for 4-20 mA DC signals. Both sides of the terminals shall be provided with test socket screws.
- B. Terminal blocks shall be Phoenix type UK-4-T-P/P or approved equal for digital signals, (contact monitoring) in control and marshaling cabinets. Terminals shall be provided with plug disconnects.
- C. Phoenix type UK 4 terminal blocks or approved equal shall be used for interpanel wiring and junction boxes.
- D. The terminal blocks shall be furnished with individual white marking strips marked by the Seller in accordance with the Buyer's drawings.
- E. All terminal blocks shall be mounted in easily accessible locations subject to the approval of the Buyer, and shall allow adequate space for handling and terminating cables. The terminal blocks shall be furnished with 20% spare terminals. Spare instrument terminals shall be spaced equally along the terminal strips.

2.05 Ground Busses

- A. Each cabinet shall contain a copper AC safety ground bus sufficient for the required number of ground connections.
- B. Each cabinet shall also contain an isolated copper DC ground bus for terminating the shields of 4-20 mA, 24V DC signal wiring.
- C. Each bus shall be complete with a connector to accept a #4 insulated ground cable.
- D. The safety ground bus and the isolated ground bus shall be 1/4 inch thick by 2 inch wide copper ground bus.

PART 3 EXECUTION

3.01 Instrument Mounting

A. All instruments on the front of the control panel shall be flush-mounted.

NEC 501 FSCGWRD

15976-3

nec \(\text{hocsprog\text{\text{kipecs\times\text{15976} doc}}} \)

Rev.A, 8/26/96

B. All rear of panel apparatus shall be rigidly mounted and not protrude from the panel. Rear support shall be provided for all front panel instruments which are 16 or more inches in length.

C. No device shall be located where it will interfere with service access to itself or other devices.

3.02 Wiring

- A. Wiring shall meet the latest requirements of the National Electric Code, and applicable state or local codes.
- B. The panels shall be wired in accordance with the wiring diagrams and/or loop diagrams. Except for low-level electronic instrumentation and 24 VDC signal wiring, all wire shall be Type SIS or approved equal, insulated for 600 volts minimum; minimum wire size shall be #18 AWG stranded, unless otherwise specified.
- C. Both ends of each wire within the panel shall be marked with the Buyer's wire designation. The markers shall be of the sleeve type with black letters on white sleeve material. Cable markers are allowed in lieu of wire markers where noted on the drawings.
- D. A solderless crimp-on ring-tongue lug shall be used on wires connected to terminals which have only a screw for securing the wire. Lugs are not required on wires connected to terminals with a tubular or box cross-section or to terminals with a screw and pressure plate.
- E. Low voltage (24V) DC wiring shall utilize Type SIS, approved equal, insulated for 300 volts minimum; minimum wire size shall be #18 AWG stranded, unless otherwise specified.
- F. All low-level electronic instrument wiring shall be mylar backed aluminum or copper foil shielded with drain wire, twisted pair, finished with a Tefzel or equivalent flame-retardant jacket; minimum wire size shall be #18 AWG strand. Low-level instrument wiring shall be run in separate raceways physically separated from 120V AC control wiring by at least 6 inches. Low voltage dc wiring may be combined with electronic instrument wiring.
- G. All Seller's terminal block wiring shall be restricted to the panel side of the blocks. The Seller shall connect no more than two wires to any terminal point. The field side of the terminal blocks shall be left completely free of wires and jumpers. Wiring on terminal blocks shall be so arranged that the Buyer will not need to connect more than two wires to the field side of any terminal point.
- H. The seller shall make provision for the support of cable clamps at the point of cable entry to the panel.

NEC 501 FSCGWRD nec \docsprog\specs\15976 doc 15976-4

Rev.A, 8/26/96

I. All multiple common connections shall be wired from the terminal blocks. Instrument connections shall not be used for termination of multiple wiring, i.e., only one wire may be connected to an instrument connection. In the event multiple connections must be used, the multiple wires shall be terminated in a single connector.

- J. Horizontal and vertical wiring between the terminal blocks and the devices shall be enclosed in raceways except that horizontal wiring between the raceways and the devices may run exposed for distances not exceeding two feet. Raceway loading shall not exceed 75% rated fill at any point.
- K. All exposed wiring shall be formed neatly with square corners and, where possible, grouped in packs. Each pack shall be bound with plastic ties and shall be substantially supported throughout its full length. Cabled wire is not acceptable.
- L. Splicing of wires on electrical circuits is not acceptable.
- M. The cases of all instruments, relays, motors and the frames of all control and switching devices shall be effectively grounded at the panel structure.
- N. Whenever the schematic or loop diagrams indicate a ground for a circuit at the panel, a single wire for each circuit thus grounded shall be run independently to the ground bus and fastened thereto using a ring lug and a machine screw inserted in a tapped hole.
- O. Three-wire duplex receptacles shall be provided as specified. The receptacles shall be installed inside the panels and be wired to a single circuit breaker or terminal strip as indicated on the wiring diagrams
- P. Panels shall be internally lighted by a fluorescent lamp with a guard when specified on the panel general arrangement drawing. A switch shall be provided convenient to the entrance access to control the interior lighting. The lamp shall be powered by 120V 60 Hz and be connected to a separate breaker in the control panel power distribution system.

3.03 System Test

A. Complete testing of all systems shall be performed following completion of panel and prior to shipment. Each input and output shall be checked. The Seller shall perform a functional test on all instruments, devices, wiring in the control panel. The tests shall verify correct wiring and proper operation of all instruments and devices. Seller shall submit test procedure for Buyer approval prior to test. The duration of this test shall be coordinated by the Buyer with the Seller two weeks prior to Buyer's scheduled test. Each point shall be documented and signed off. The Buyer shall witness all of these tests

NEC 501 FSCGWRD

- and sign off the test documentation prior to shipment and acceptance of the control panels.
- B. All annunciator wiring shall be tested by simulating external alarm contact position during and normal conditions.
- C. Test reports shall be submitted to the Buyer.

END OF SPECIFICATION NO. 15976

SPECIFICATION NO. 15977 GENERAL INSTRUMENTS AND CONTROLS

PART 1 **GENERAL**

1.01 General Requirements

- This specification and the instrument data sheets cover the requirements for A. sensors, controllers, transmitters, indicators, switches, alarms, and other instruments for flow, pressure, and level.
- B. All instruments, to the maximum extent possible, shall be manufacturer's standard stock and shall conform to the applicable standards for their respective application. Instrument wiring shall be electrically isolated from the instrument case.

1.02 **Document Requirements**

- Outline and Assembly Drawings and Wiring Diagrams A.
 - Seller shall supply outline dimension drawings, assembly drawings, and I. wiring diagrams.

В. Spare and Repair Parts

I. Seller shall supply a listing of spare and repair parts for 18 months. Additionally, as much as practicable, seller shall select instruments including field replaceable subassemblies to facilitate standardization and minimize the number of spares and procedures.

Instrument Data Sheets C.

I. The seller shall indicate manufacturer's information including model numbers on the instrument data sheets provided by the Buyer.

D. Operations, Maintenance and Other Instructions

Operations and maintenance instructions shall be furnished for the I. instruments. Seller shall also furnish installation and site storage and handling instructions.

E. **Procedures**

I. Seller shall supply its standard inspection procedures, mechanical and electrical performance test procedures. Seller shall also supply the packaging and shipping procedures used to ship finished equipment from its facility to the jobsite, and field calibration data and procedures.

15977-1 **NEC 501 FSCGWRD** Rev.A, 8/26/96 nec \docsprog\specs\15977 doc

1.03 Codes and Standards

A. All systems and devices shall be conform to applicable standards (latest editions) of the following institutes, societies and associations:

ANSI	American National Standards Institute, Inc.
ASME	American Society of Mechanical Engineers
ASTM	American Society of Testing & Materials
ISA	Instrument Society of America
NEC	National Electrical Code of National Fire Protection Association
NEMA	National Electrical Manufacturer's Association
UL	Underwriter's Laboratories, Inc.

1.04 Preparation for Shipment

- A. All valves and instrument openings shall be closed with suitable non-metallic covers designed to protect the openings during shipment and storage.
- B. Prior to preparing the instruments for shipment, all accessories and components which may be subject to damage either during shipment or during handling at the job site shall be removed, properly labeled and shipped separately from the equipment.

PART 2 PRODUCTS

2.01 Materials and Equipment Requirements

- A. Electrical Requirements
 - I. Instruments requiring power supply (i.e. 4-wire transmitter) shall be powered by 120V AC, 60 Hertz, 1 Phase provided by buyer.

B. Electronic Requirements

- I. Electronic instruments, in addition to transforming process parameters into electrical output signal, shall include one or more of the following as required on the instrument data sheets:
 - a. Arithmetical functions including ratio, integration, totalization, signal limiting, high/low selection, proportional, differential and square root extraction.
 - b. Discrete (on-off) signal or generate a varying electric control signal to operate a final control element.
 - c. A signal magnitude indication.

II. The electronic instrument standard signal shall be in accordance with ISA-S50.1 as follows:

- a. Transmitters: The output signal shall be linear unless otherwise specified on the data sheets and shall be a variable current having a range of 4 to 20 mA DC. Transmitters shall be a 24V DC isolated system and shall have a minimum accuracy of $\pm 2\%$ of full scale.
- b. Receivers: The standard input signal shall be a current of 4 to 20 mA DC. The standard output signal shall be a current of 4 to 20 mA DC and shall deliver rated current into an external load impedance of 750 ohms or less.
- c. Pressure, flow, and level switches shall have one DPDT (Double Pole, Double Throw) contact minimum per setpoint. When dual setpoints are specified on the data sheets, the adjustments shall be independent for each switch. Switch deadband shall be adjustable if specified on data sheets.
- e. Static switch contact output for Buyer's use shall have a minimum contact rating of 120V AC, 10 amperes resistive, 6 amperes inductive and 3 amperes resistive at 48V DC. Switch shall be snapacting. Dead band shall be adjustable.
- f. Electronic switch contact output for Buyer's use shall have a minimum power rating of 120V AC, 2.5 amperes inductive, or 2 amperes resistive at 48V DC.

C. Alarms and Shutdowns

I. All controls and alarm switches shall be "fail-safe", i.e., an abnormal condition shall cause a loss in output signal. Upon loss of power, control circuits and alarms shall go to the "fail-safe" condition. The "fail-safe" condition of valves and solenoid valves will be specified on the data sheets. The "fail-safe" condition will be defined by the process requirement. All alarm contacts shall open to alarm.

D. Panel Mounted Instruments

- I. Panel mounted instruments shall be furnished with all mounting hardware required as part of the instrument.
- II. Electronic instruments shall be manufacturer's standard product and shall be of modular construction and interchangeable for the intended function among the instruments of the same type.

III. Indicating and controlling instruments shall either receive or produce a 4-20 mA DC signal.

- IV. Instruments mounted on panel faces that are hinged to swing open shall be installed with adequate slack wiring, neatly bundled and dressed, and secured in a manner that will prevent pinching or damaging the conductors as panel faces are opened or closed.
- V. All electrical instruments shall be UL listed.

F. Field Mounted Instruments

I. General Requirements

- a. Instruments, wherever possible, shall be of the manufacturer's standard type, using scales of the standard ranges. Wherever practical, consideration shall be given to standardization with existing instruments.
- b. All flanges shall be in accordance with ANSI B16.5.
- c. All sensing devices shall be selected for a minimum accuracy of + or 2% at full scale unless otherwise specified.
- d. All scales shall be designed to read directly in engineering units and to be linear. Exceptions shall be: Level shall read in percentage, 0 to 100%
- e. All pressure gages, indicators, etc., shall reflect normal process operating variables at approximately 2/3 of the measuring device scale.

II. Pressure Instruments

- a. Pressure gauges shall be constructed in accordance with the following:
 - i. Gauges shall be Bourdon tube type and gauge dials shall be sized for ease of reading, taking ranges and tolerances into account. The smallest dial size shall be 4 1/2".
 - ii. The elastic element shall be of material suitable for the intended service. The range shall be chosen such that the operating conditions fall within 40% to 65% of the scale.
 - iii. All gauges within the classified areas shall be hermetically sealed. (as noted on instrument data sheets)

> iv. All gauges shall have blowout protection at the rear of the instrument and shatterproof glass or acrylic windows.

> v. Diaphragm seals shall have flanged or screwed connection as specified on data sheets. All non-compatible with the service and environmental conditions; 1/4-in NPT connections shall be provided for the process fluid

IV. Flow Instruments

Magnetic flowmeters shall be used on conductive fluids (>5 a. micromhos) and where wide rangeability is required. Magmeters shall be installed, whenever possible, in an upward flowing vertical pipe. Magmeter electronics shall be housed in a separate NEMA 4 enclosure located in the general vicinity as the in-line body.

V. Level Gauge Glasses

- Level gauge glasses shall be of the reflex type with inlet and outlet a. ball check valves, and provided with manual isolation valves for calibration and maintenance.
- The transparent element shall be tempered borosilicate glass, b. resistant to thermal and mechanical shock unless unsuitable for the intended service.

VI. Relieving Devices

- All safety valves shall be marked and certified in accordance with a. the ASME Boiler and Pressure Vessel Code. Small screwed valves may be exempted from this requirement.
- Relief valve sizing shall comply with all applicable codes and shall b. be as specified on the valve data sheets.

2.02 Identification and Tagging Requirements

- All instruments shall be given instrument tag numbers. These numbers shall Α. be used to identify all instrumentation on data sheets, flowsheets, location drawings, piping drawings, and electrical drawings. Instrument tagging shall be per ISA Standards S 5.1 and S 5.3.
- All instruments shall be provided with instrument tags. Tags shall be of В. stainless steel material and a minimum of 3/4-in. wide and 3-in. long. numbers shall be used to identify all instrumentation on data sheets, flowsheets, location drawings, piping drawings, and electrical drawings. Instrument tagging shall be per ISA Standards S 5.1 and S 5.3.

15977-5 **NEC 501 FSCGWRD** Rev.A, 8/26/96 nec \docsprog\specs\15977 doc

PART 3 EXECUTION

3.01 Maintenance Philosophy

Instruments shall be mounted to provide easy access for operation and A. maintenance. Instruments requiring calibration shall be installed with unions and isolation valves to permit removal. Local indicating instruments shall be visible and accessible for maintenance from the normal floor level.

3.02 **Instrument Calibration**

Α. Instrument calibration at the job site will be by the Buyer.

3.03 Installation

Cabling and Interconnection A.

I. All instrumentation wiring for connection to external circuits shall be designed to be wired to terminal blocks or patch panels to facilitate installation, start-up and maintenance. Each terminal block shall be uniquely labeled and each point on the terminal block shall be numbered.

II. Additionally, the following requirements shall apply:

- All insulation and clearances shall be selected and designed so a. that the energized parts shall withstand a high potential test of at least three times the worst-case voltage differential.
- Each shield shall be connected to a separate terminal point. b.
- Cable routing design shall be from point to point without splices, c. with the exception of devices supplied with pigtail leads.
- Wiring diagrams shall identify each terminal in use as well as d. those identified for future use.
- Cables shall be properly identified at each end with none. conducting labels

В. Instrument Tubing and Piping

- I. All impulse lines shall be designed for personnel safety and to facilitate calibration, maintenance, and/or replacement. This shall be accomplished by the following, as a minimum:
 - All instrument systems shall be designed with supports to ensure a. proper operation. Supports shall include strain relief on connections to mitigate the consequences of material fatigue.

NEC 501 FSCGWRD 15977-6 Rev.A, 8/26/96 nec \docsprog\specs\15977 doc

b. Tubing connections shall be located so that adequate space is available for leak tests and replacement of tubing fittings without disturbing adjacent tubing connections.

- c. Instruments mounted on process lines shall be provided with instrument root valves to facilitate isolation and removal of the instrument.
- d. Refer to Specification No. 15410 for technical requirements for root valves.

C. Grounding, Shielding and Isolation

- I. The grounding, shielding and isolation requirements shall be as follows:
 - a. A single point ground will be established for all components. This ground will carry no current and will provide the ground reference for Instrument and Control Systems.
 - b. Shields shall be provided for low-voltage signal cables, as required to mitigate the consequences of Electro-magnetic Coupling (EMC).
 - c. Conductors in panels, racks, and enclosures shall be properly isolated to prevent inadvertent contact by personnel. This requirement applies to conductors not normally accessible to operators, but accessible to maintenance personnel.
 - d. Personnel shall be protected from potential electrical hazards by insulation against voltages three times as large as those under faulted conditions.

3.04 Inspection and Shop Testing

A. All instruments provided in accordance with the requirements of the instrument data sheets requiring shop testing shall be inspected and fully functionally tested in the seller's shop prior to shipment to the job site. Shop tests shall demonstrate all required functions of the instruments for compliance with the functional requirements of this specification and the data sheets. Shop testing shall be conducted using the seller's standard testing procedure. Seller shall calibrate all instruments in accordance with the National Institute of Standards and Technology (NIST) standards and shall supply data and procedures for field calibration as stated in section 1.02(E) of this specification.

END OF SECTION 15977

SPECIFICATION NO. 15979 CONTROL VALVES

PART 1 GENERAL

1.01 General Requirements

- A. This specification covers the requirements for the design, manufacturing, testing, delivery to the site, and technical direction of calibration and initial startup of control valves and their accessories.
- B. These requirements are contained in the text and in the data sheets. Where they differ, requirements specified on the data sheets apply.

1.02 Work to be provided

- A. The work to be provided by the Seller shall include the following:
 - I. Sizing of the control valves, complete with operators and accessories in the "Control Valves Data Sheet (s)," hereinafter referred to as Data Sheets.
 - II. Special tools required for the installation and maintenance of the valves.
 - III. Delivery of the valves to the project site.
 - IV. Technical direction of calibration and initial startup operation of the valves (if specifically requested in the material requisition).

1.03 Codes and Standards

A. All systems and devices shall comply with applicable standards (latest editions) of the following institutes, societies and associations:

ANSI	American National Standards Institute, Inc.
ASME	American Society of Mechanical Engineers
ASTM	American Society of Testing & Materials
ISA	Instrument Society of America
NEC	National Electrical Code of National Fire Protection Association
NEMA	National Electrical Manufacturer's Association
UL	Underwriter's Laboratories, Inc.

1.04 Preparation for shipment

- A. All valves openings shall be closed with suitable non-metallic covers designed to protect the openings during shipment and storage.
- B. Each valve assembly shall be properly marked, identified and crated.

C. Prior to preparing the valves for shipment, all accessories and components which may be subject to damage either during shipment or during handling at the job site shall be removed, properly labeled, and shipped separately from the equipment.

PART 2 **PRODUCTS**

- 2.01 Design Conditions and Performance Requirements
 - Α. Control valves shall be designed for the service conditions specified in the Data Sheets.
 - B. Design pressure shall be at a maximum temperature specified in the Data Sheets when selecting valve body rating. The pressure-temperature ratings of valves shall comply with ANSI B16.34.
 - C. All valves shall comply with OSHA requirements and meet a maximum noise level of 90 dba at a distance of 3 feet with the valve body bare and uninsulated.

2.02 Valve Sizing

- Seller shall calculate and verify the appropriate valve size and trim for the Α. application to encompass the minimum, normal, and maximum flow conditions stated in the data sheet.
- 2.03 Materials and Equipment Requirements
 - Materials for control valves shall be as specified in the data sheets. Where the Α. material for a specific component or part is not specified, it shall be selected by Seller for approval by the Buyer.
- Design and Construction Features 2.04
 - Valves A.
 - I. Valve bodies shall be of the material specified on the valve data sheets. As a minimum, the valve trim and stem shall be of stainless steel and suitable for the specified design conditions.
 - II. The pressure retaining parts of valves shall be design in accordance with the requirements of ANSI B31.1 and B16.34
 - Ill. Valve flanges shall be in accordance with ANSI B16.5.
 - Split valve bodies are not acceptable.
 - V. If specified in the Data Sheets under "Special Requirements," valves constructed with body material different from that of either the upstream or downstream piping shall have pipe fitting (pipe spools) shop butt-welded to the valve-weld end. Where used, they shall be shown on Seller valve outline drawings including the shop end-to-end or center-to-end dimensions.

NEC 501 FSCGWRD 15979-2 nec \docsprog\specs\15979 doc

B. Body and Bonnet

- I. Valve stem or shaft shall be sealed by means of a bolted packing box. Packing gland shall be equipped with flange style followers. Packing shall be as follows unless process fluid or conditions as specified on the data sheets require others.
 - II. For moderate temperature services TFE V-Ring shall be used. Temperature limits are to be based on bonnet design and manufacturer's recommendation.
 - III. A lubricator and an isolating valve shall be provided when packing requires lubrication.
 - IV. Bolted bonnets shall be furnished for all valves NPS 1" and larger.

C. Trim

- I. Balanced type valves shall have a leakage rate of Class II or better unless otherwise specified.
- II. Globe body valves shall have inner valve removable through the top of the valve body. These valves shall also have removable seat rings and solid type plugs.

D. Pressure Regulating Valves

I. Self-regulating control valves shall be provided as specified. Droop and regulation shall be \pm 10 percent maximum.

E. Relief Valves

- I. Safety relief valves shall be in accordance with applicable local, state, and national code requirements and shall be provided as specified and indicated.
- II. Relief valve sizing: The basis of the selection and application of pressure relieving devices shall be in accordance with applicable portions of ASME Boiler and Pressure Vessel Code, Section VIII.
- III. Markings: Safety relief valves shall be marked and code stamped in accordance with ASME Boiler and Pressure Vessel Code, Section VIII where applicable.

F. Welding and Repair Welding

I. Welding for steel valves and repair welding of base material defects shall be in accordance with the requirements of ANSI B31.1 and B16.34.

M. Special Tools

I. Contractor shall provide one complete set of all necessary special tools required for installation, operating and maintenance of the valves, operators, and accessories. The design shall be such the need for special tools is minimized.

N. Tagging

- I. The instruments shall have a nameplate, securely attached to the equipment at a location easily readable. The nameplate shall contain the following information as a minimum:
 - a. Tag number
 - b. Manufacturer's name
 - c. Model number
 - d. Serial number
 - e. Instrument range

PART 3 EXECUTION

3.01 Shop and Field Testing

A. Shop Tests

- I. Seller shall test all control and indicating components to assure accuracy is within published limits. Seller shall establish and maintain a calibration program that meets the requirements of the buyer.
- II. Hydrostatic test shall be performed on each valve body in accordance with ANSI B16.34.
- III. Valve seat leakage tests shall be performed in accordance with ANSI B16.104 with "Leakage Class" as follows:
- IV. After final assembly of positioners, all control valves shall be stroke tested for accuracy of operation.

NEC 501 FSCGWRD

15979-4

nec \docsprog\specs\15979 doc

V. Certified copies of test reports covering all shop tests shall be submitted to the Buyer.

B. Field Tests

I. Field tests shall be performed on each valve after installation. The object of these tests will be to check the mechanical performance of the valves in regard to opening and closing operation and also to check for any visible or audible leakage or other malfunction.

3.02 Painting

A. It is expected that surface preparation and painting of control valves, actuators, and accessories will be in accordance with sellers standard procedures

END OF SPECIFICATION NO. 15979

SECTION 16050 BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

1.01 Summary

- A. This Specification includes the technical requirements for furnishing and installing of building wiring, supporting devices, raceways, fittings, boxes, enclosures and electrical identification.
- B. The entire installation shall be in strict accordance with the requirements of NFPA 70 (National Electric Code).
- C. Site preparation shall be in accordance with Section 02100.

1.02 References

- A. Comply with NFPA 70 for components and installation.
- B. Listing and Labeling: Provide products specified in this Section that are listed and labeled:
 - I. The Terms "Listed and Labeled": As defined in the National Electrical Code, Article 100.

1.03 Submittals

A. Submit Product Data for supporting devices, raceways, fittings, boxes, enclosures and electrical identification.

1.04 Codes and Standards

ANICT

A. All systems and devices shall be per applicable standards (latest editions) of the following institutes and associations:

American National Standards Institute Inc

MINOI	American National Standards institute, Inc.
NECA	National Electrical Contractors Association
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
UL	Underwriter's Laboratories, Inc.

PART 2 **PRODUCTS**

2.01 Building Wire and Cable

- Single conductor, copper. Solid conductor for No. 10 AWG and smaller; A. stranded conductor for larger than No. 10 AWG. UL-Listed. Type THHN/THWN, 90° crating.
 - I. Thermoplastic Insulated Wire: Conform to NEMA WC 5.
 - II. Connectors and Splices: Units of size, amp rating, material, type, and class suitable for service indicated. Select to comply with Project's installation requirements.
- В. Channel and angle support systems, hangers, anchors, sleeves, brackets, fabricated items, and fasteners are designed to provide secure support for electrical components.
 - I. Material: Steel, except as otherwise indicated, protected from corrosion with zinc coating or with treatment of equivalent corrosion resistance using approved alternative finish or inherent material characteristics.
 - II. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel, except as otherwise indicated.
- C. Steel channel supports have 9/16-inch (14-mm) diameter holes at a maximum of 8 inches (203 mm) o.c., in at least 1 surface. Fittings and accessories mate and match with channels and are from the same manufacturer.
- D. Colored Adhesive Marking Tape for Raceways, Wires, and Cables: Selfadhesive vinyl tape not less than 3 mils thick by 1 inch wide (0.08 mm thick by 25 mm wide).
- E. Color-Coding Cable Ties: Type 6/6 nylon, self-locking type. Colors to suit coding scheme.
- F. Exterior Warning and Caution Signs: Weather-resistant, nonfading, preprinted, cellulose acetate butyrate signs with 0.0396-inch (1-mm), galvanized steel backing, with colors, legend, and size appropriate to the application. 1/4-inch (6.4-mm) grommets in corners for mounting.
- G. Fasteners for Metal Signs: Self-tapping stainless-steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.

16050-2 nec \docsprog\specs\16050 doc Rev.A, 8/26/96

2.02 Conduit and Fittings

- Rigid Steel Conduit: ANSI C80.1 A.
- В. Plastic-Coated Steel conduit and Fittings: NEMA RN 1.
- C. Liquidtight Flexible Metal Conduit: Flexible steel conduit with PVC jacket.
- D. Rigid non-metallic conduit, PVC schedule 40.
- E. Fittings: NEMA FB 1, compatible with conduit and tubing.
- 2.03 Outlet and Device Boxes
 - Cast Metal Boxes: NEMA FB 1, cast aluminum with gasketed cover. A.
- 2.04 Pull and Junction Boxes
 - A. Cast Metal Boxes: NEMA FB 1, cast aluminum with gasketed cover.
- 2.05 Precast Concrete Pull Boxes
 - A. Precast concrete pull boxes for underground electrical conduits, designated "HH" in the drawings shall be provided with end bells for conduit entrance, and shall be sized as noted on the drawings.
- 2.06 Wiring Devices
 - A. Ground-Fault Circuit Interrupter (GFCI) Receptacles: UL Standard 943, "Ground Fault Circuit Interrupters," termination type, with integral NEMA 5-20R duplex receptacle. Design units for installation in a 2-3/4-inch (70-mm) deep outlet box without adapter.
- 2.07 **Exterior Lighting**
 - A. Metal Parts: Free from burrs, sharp edges, and corners.
 - B. Rigidly formed, weather-and-light-tight enclosure that will not warp, sag, or deform.
 - C. Lighting Fixture: 150 watt fixtures shall be as shown on the drawings.
- 2.08 **Electric Motors**
 - A. Motors shall meet NEMA MG 1 Standards and shall be suitable for the intended service.

NEC 501 FSCGWRD 16050-3 Rev A, 8/26/96

PART 3 **EXECUTION**

Install components and equipment to provide the maximum possible A. headroom where mounting heights or other location criteria are not indicated.

- В. Install items level, plumb, and parallel and perpendicular to other systems and components, except where otherwise indicated.
- C. Install equipment to facilitate service, maintenance, and repair or replacement Connect for ease of disconnecting, with minimum of components. interference with other installations.
- Give right of way to raceways and piping systems installed at a required slope. D.
- E. Feeders and Branch Circuits: Type THHN/THWN, copper conductor, in raceway, except as otherwise indicated.
- F. Damp Locations and Outdoors Supports: Hot-dip galvanized materials or nonmetallic, U-channel system components.
- G. Strength of Supports: Adequate to carry all present and future loads, times a safety factor of at least 4; 200-lb- (90-kg-) minimum design load.
- H. Install wires in raceway according to manufacturer's written instructions and NECA's "Standard of Installation." Manufacturer's allowable pulling tension and bending radius shall not be exceeded. Keep splices to the minimum.
- I. Wiring at Outlets: Install with at least 12 inches (300 mm) of slack conductor at each outlet.
- J. Connect outlets and components to wiring systems and to ground as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torquetightening values for equipment connectors. Where manufacturer's torque requirements are not indicated, tighten connectors and terminals according to tightening requirements specified in UL 486A.
- K. Install devices to securely and permanently fasten and support electrical components.
- M. Vertical Conductor Supports: Install simultaneously with conductors.
- N. Miscellaneous Supports: Install metal channel racks for mounting cabinets, panelboards, disconnects, control enclosures, pull boxes, junction boxes, and other devices.

NEC 501 FSCGWRD 16050-4 Rev.A, 8/26/96

O. In open spaces, cast boxes threaded to raceways need not be separately supported.

- P. Sleeves: Install for cable and raceway penetrations of concrete slabs, except where core-drilled holes are used..
- Q. Fastening: Unless otherwise indicated, securely fasten electrical items and their supporting hardware.
- R. Install identification devices where required.
 - I. Install labels where indicated and at locations for best convenience of viewing without interference with operation and maintenance of equipment. Use consistent designations throughout the Project.
 - II. Self-Adhesive Identification Products: Clean surfaces of dust, loose material, and oily films before applying.
 - Ill. Tag or label circuits in raceways and enclosures. Identify source and circuit numbers in each cabinet, pull box, junction box, and outlet box.
 - IV. For panelboard, provide framed, typed circuit schedule with explicit description and identification of items controlled by each individual breaker.
- S. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer instructions.
- T. Install horizontal raceway runs above water piping.
- U. Complete raceway installation before conductor installation.
- V. Use temporary closures to prevent foreign matter from entering raceway.
- W. Use raceway fittings compatible with raceway and suitable for use and location. Use insulating bushings to protect conductors.
- X. Install No. 14 AWG zinc-coated steel or monofilament plastic pull wires, having not less than 200-lb tensile strength, in empty raceway. Leave not less than 12 inches of slack at each end of the pull wire.
- Y. Use maximum of 6 feet of flexible conduit for equipment subject to vibration or movement, and for all motors. Use liquidight flexible conduit in wet or damp locations. Install separate ground conductor across flexible connections,
- Z. Provide grounding connections for raceway, boxes, and components as indicated and instructed by manufacturer. Tighten connectors and terminals, including bolts and screws, according to manufacturer's published torque-

NEC 501 FSCGWRD

16050-5

nec \(\text{Nec \(\text{Vdccsprog} \\ \text{Specs\(\text{Vdc}} \) \)

Rev. A, \(8/26/96 \)

tightening values for equipment connectors. Where manufacturer's torque tightening torques specified in UL Standard 486A.

END OF SECTION 16050

SPECIFICATION NO. 16452 GROUNDING

PART 1 GENERAL

1.01 Summary

A. This Specification includes grounding of electrical systems and equipment and basic requirements for grounding for protection of life, equipment, circuits, and systems. grounding requirements specified in this specification may be supplemented in other specifications.

1.02 References

- A. Comply with NFPA 70.
- B. Comply with UL 467.
- C. Listing and Labeling: Provide products specified in this Specification that are listed and labeled.
 - I. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.

1.03 Submittals

A. Submit Product Data for grounding rods, connectors and connection materials, and grounding fittings according to the Conditions of the Contract and Division 1 Specifications.

1.04 Codes and Standards

A. Grounding requirements shall be per applicable standards (latest editions) of the following:

ASTM American Society for Testing and Materials

IEEE Institute of Electrical and Electronic Engineers, Inc.

NFPA National Fire Protection Association

UL Underwriter's Laboratories

PART 2 PRODUCTS

2.01 Grounding and Bonding Products

A. Where types, sizes, ratings, and quantities indicated are in excess of National Electrical Code requirements, the more stringent requirements and the greater size, rating, and quantity indications govern.

NEC 501 FSCGWRD

2.02 Wire and Cable Grounding Conductors

- A. Comply with Specification No. 16050 "Basic Electrical Materials and Methods." Conform to National Electrical Code Table 8, except as otherwise indicated, for conductor properties, including stranding.
 - I. Material: Copper. Use only copper wire for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.
 - II. Equipment Grounding Conductors: Insulated with green color insulation.
 - Grounding-Electrode Conductors: Stranded cable. III.
 - IV. Underground Conductors: Bare, tinned, stranded, except as otherwise indicated.
 - Bare Copper Conductors: Conform to the following: V.
 - Solid Conductors: ASTM B 3. a.
 - Assembly of Stranded Conductors: ASTM B 8. b.
 - Tinned Conductors: ASTM B 33.
- 2.03 **Braided Bonding Jumpers**
 - Copper tape, braided No. 30 AWG bare copper wire, terminated with copper ferrules.
- 2.04 **Bonding Straps**
 - Soft copper, 0.05 inch (1 mm) thick and 2 inches (50 mm) wide, except as indicated.
- 2.05 Pressure Connectors
 - High-conductivity-plated units.
- 2.06 **Bolted Clamps**
 - Heavy-duty type.
- 2.07 **Exothermic-Welded Connections**
 - Provided in kit form and selected per manufacturer's written instructions for specific types, sizes, and combinations of conductors and connected items.
- 2.08 **Grounding Rods**
 - Sectional type; copper-clad steel.
 - I. Size: 3/4 inch by 120 inches (19 by 3000 mm).

NEC 501 FSCGWRD 16452-2 Rev.A, 8/26/96 nec \docsprog\specs\16452 doc

PART 3 EXECUTION

3.01 **Equipment Grounding Conductors**

- Comply with the National Electrical Code Article 250 for types, sizes, and Α. quantities of equipment grounding conductors, except where specific types, larger sizes, or more conductors than required by National Electrical Code are indicated.
 - I. Install equipment grounding conductor with circuit conductors for the items below in addition to those required by Code:
 - Feeders and branch circuits.
 - Lighting circuits. b.
 - Receptacle circuits. c.
 - Single-phase motor or appliance branch circuits. d.
 - Flexible raceway runs.

3.02 Installation

- Ground electrical systems and equipment according to National Electrical Code requirements, except where Drawings or Specifications exceed National Electrical Code requirements.
 - I. Grounding Rods: Locate a minimum of 1-rod length from each other and at least the same distance from any other grounding electrode.
 - Drive until tops are 2 inches (50 mm) below finished floor or final a. grade, except as otherwise indicated.
 - Interconnect with grounding-electrode conductors. Use exothermic b. welds as indicated. Make these connections without damaging copper coating or exposing steel.
 - II. Grounding Conductors: Route along the shortest and straightest paths possible, except as otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
 - III. Underground Grounding Conductors: Use bare copper wire. Bury at least 24 inches (600 mm) below grade.

3.03 Connections

Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

NEC 501 FSCGWRD 16452-3 Rev.A, 8/26/96 nec \docsprog\specs\16452 doc

Specifications Appendix D

> I. Use electroplated or hot-tin-coated materials to assure high conductivity and to make contact points closer in order of galvanic series.

- II. Make connections with clean, bare metal at points of contact.
- ·III. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
- Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
- V. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- VI. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections, except those at test wells. Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
- VII. Equipment Grounding-Wire Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
- VIII. Noncontact Metal Raceway Terminations: Where metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at both entrances and exits with grounding bushings and bare grounding conductors, except as otherwise indicated.
- IX. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. Where these requirements are not available, use those specified in UL 486A and UL 486B.
- XX. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by manufacturer of connectors. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.
- XXI. Moisture Protection: Where insulated grounding conductors are connected to grounding rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

NEC 501 FSCGWRD 16452-4 Rev.A, 8/26/96 nec \docsprog\specs\16452 doc

3.04 Tests

A. Subject the completed grounding system to a megger test at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Measure ground resistance not less than 2 full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests by the 2-point method according to IEEE 81.

- I. Maximum grounding to resistance values are as follows:
 - a. Equipment Rated 500 kVA and Less: 10 ohms.
 - b. Equipment Rated 500 to 1000 kVA: 5 ohms.
 - c. Equipment Rated More than 1000 kVA: 3 ohms.
 - d. Manhole Grounds: 10 ohms.
- II. Excessive Ground Resistance: Where resistance to ground exceeds specified values, notify Engineer promptly and include recommendations to reduce ground resistance and to accomplish recommended work.

END OF SPECIFICATION NO. 16452

SPECIFICATION NO. 16470 PANELBOARDS

PART 1 GENERAL

1.01 Summary

A. This Specification includes the technical requirements for furnishing, installing and testing of lighting and power panelboards and associated auxiliary equiment rated 600 V or less.

1.02 References

- A. Listing and Labeling: Provide products specified in this Specification that are listed and labeled.
 - I. The Terms "Listed" And "Labeled": As defined in the National Electrical Code, Article 100.
 - II. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
- B. Electrical Component Standard: NFPA 70, "National Electrical Code" for components and installation.
- C. NEMA Standard: NEMA PB1, "Panelboards."
- D. UL Standards: UL 61, "Panelboards," and UL 50, "Cabinets and Boxes."
- E. Extra Materials: Furnish the following:
 - I. Keys: Furnish six spares of each type for panelboard cabinet locks.
 - II. Touch-up paint for surface-mounted panelboards: One half-pint container.

1.03 Submittals

- A. Submit shop drawings of panelboards, including dimensioned tabulations of installed devices and major features. Include enclosure details for types other than NEMA Type 1, bus configuration and current ratings, short-circuit current rating of panelboards, and features, characteristics, ratings, and settings of individual protective devices and auxiliary components.
- B. Submit wiring diagrams detailing schematic diagrams including control wiring and differentiating between manufacturer-installed and field-installed wiring.

C. Submit reports of field tests and observations certified by the testing organization.

1.04 Codes and Standards

A. Panelboard requirements shall be per applicable standards (latest editions) of the following:

IEEE Institute of Electrical and Electronic Manufactures Association

NFPA National Fire Protection Association

OSHA Occupational Safety Health Administration

UL Underwriter's Laboratories

PART 2 PRODUCTS

2.01 Manufacturers

- A. Subject to compliance with requirements, provide products by the following:
 - I. General Electric Co.
 - Il. Westinghouse Electric Corp.

2.02 Panelboards

- A. Conform to the following general requirements:
 - Overcurrent Protective Devices (OCPDs): Provide types, ratings, and features as indicated.. Tandem circuit breakers shall not be used. Multipole breakers shall have common trip.
 - II. Enclosure: Cabinet, free standing as indicated. NEMA Type 3R enclosure.
 - III. Front: Secured to box with concealed trim clamps except as indicated. Front for surface-mounted panels shall be same dimensions as box.
 - IV. Directory Frame: Metal; mounted inside each panel door.
 - V. Bus: Hard drawn copper of 98 percent conductivity.
 - VI. Main and Neutral Lugs: Compression type.
 - VII. Equipment Ground Bus: Adequate for feeder and branch circuit equipment ground conductors. Bonded to box.
 - VIII. Neutral Bus: Adequate for feeder and branch circuit neutral.

2.03 Special Features

- A. Provide the following as indicated.
 - I. Service Entrance and Metering Facilities.

NEC 501 FSCGWRD
nec \docsprog\specs\16470 doc

16470-2

Rev.A, 8/26/96

- II. Isolated Equipment Ground Bus: Adequate for branch circuit equipment ground conductors; insulated from box.
- III. Hinged Front Cover: Entire front trim hinged to box with standard door within hinged trim cover.

2.04 Surge Arresters

- A. IEEE C62.11, "Standards for Metal-Oxide Surge Arresters for AC Power Circuits," or IEEE C62.1, "Surge Arresters for Alternating Current Power Circuits."
 - I. Description: Coordinate impulse sparkover voltage with system circuit voltage and provide factory mounting with UL-recognized mounting device.

2.05 Lighting and Appliance Branch Circuit Panelboards

- A. Conform to the following requirements:
 - I. Branch OCPDs: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
 - II. Doors: In panel front, with concealed hinges. Secure with flush catch and tumbler lock, all keyed alike.
 - III. Interiors: Provide physical means to prevent installation of more OCPDs than the quantity for which the enclosure was listed.
 - IV. Main, Neutral, and Ground Lugs and Buses: Have mechanical connectors for conductors.

2.06 Accessory Components and Features

- A. Provide the following:
 - I. Accessory Set: Include tools and miscellaneous items as required for overcurrent protective device test, inspection, maintenance, and operation.
 - II. Portable Test Set: Arranged to permit testing of functions of solid-state trip devices without removal from panelboard.

2.07 Identification

A. Panelboard Nameplates: Engraved laminated plastic or metal nameplate for each panelboard mounted with epoxy or industrial cement or industrial adhesive.

NEC 501 FSCGWRD
nec \docsprog\specs\16470 doc

16470-3

Rev.A, 8/26/96

PART 3 EXECUTION

3.01 Installation, General

- A. Install panelboard and accessory items in accordance with NEMA PB 1.1, "General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less," and manufacturers' written installation instructions.
- B. Install filler plates in unused spaces.
- C. Tighten electrical connectors and terminals including grounding connections in accordance with manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated; use those specified in UL 486A and UL 486B.

3.02 Ground Fault Protection

A. Install panelboard ground fault circuit interrupter devices in accordance with installation guidelines of NEMA 289, "Application Guide for Ground Fault Circuit Interrupters."

3.03 Mounting

A. Plumb and rigid without distortion of box.

3.04 Circuit Directory

A. Typed and reflective of final circuit changes required to balance panel loads. Obtain approval before installing.

3.05 Wiring in Panel Gutters

A. Train conductors neatly in groups; bundle and wrap with wire ties after completion of load balancing.

3.06 Tests

- A. Schedule tests with at least one week advance notification.
 - I. Report of Tests and Observations: Provide a written report of tests and observations. Report defective materials and workmanship and unsatisfactory test results. Include records of repairs and adjustments made.
 - II. Labeling: Upon satisfactory completion of tests and related effort, apply a label to tested components indicating results of tests and inspections, responsible organization and person, and date.
 - III. Protective Device Ratings and Settings: Verify installed components conform to indicated ratings and settings and make the final system adjustments of OCPDs.

3.07 Visual and Mechanical Inspection

- A. Include the following inspections and related work:
 - Inspect for defects and physical damage, labeling, and nameplate compliance with requirements of up-to-date drawings and panelboard schedules.
 - II. Exercise and perform of operational tests of all mechanical components and other operable devices in accordance with manufacturer's instruction manual.
 - III. Check panelboard mounting, area clearances, and alignment and fit of components.
 - IV. Check tightness of bolted electrical connections with calibrated torque wrench. Refer to manufacturer's instructions for proper torque values.
 - V. Perform visual and mechanical inspection and related work for overcurrent protective devices as specified in Division 16 Section "Overcurrent Protective Devices."

3.08 Electrical Tests

- A. Include the following tests:
 - Insulation resistance test of buses and portions of control wiring that disconnect from solid-state devices. Insulation resistance less than 100 megohms is not acceptable.
 - II. Ground resistance test on system and equipment ground connections.
 - III. Inspect, service, and test main and subfeed overcurrent protective devices in accordance with section "Overcurrent Protective Devices."

3.09 Retesting

A. Correct deficiencies identified by tests and observations and provide retesting of panelboards by testing organization. Verify by the system tests that the total assembly meets specified requirements.

3.10 Balancing Loads

- A. After Substantial Completion but not more than two months after Final Acceptance, conduct load-balancing measurements and circuit changes as follows:
 - I. Perform measurements during period of normal working load as advised by the Engineer.

NEC 501 FSCGWRD
nec \docsprog\specs\16470 doc

16470-5

Rev.A, 8/26/96

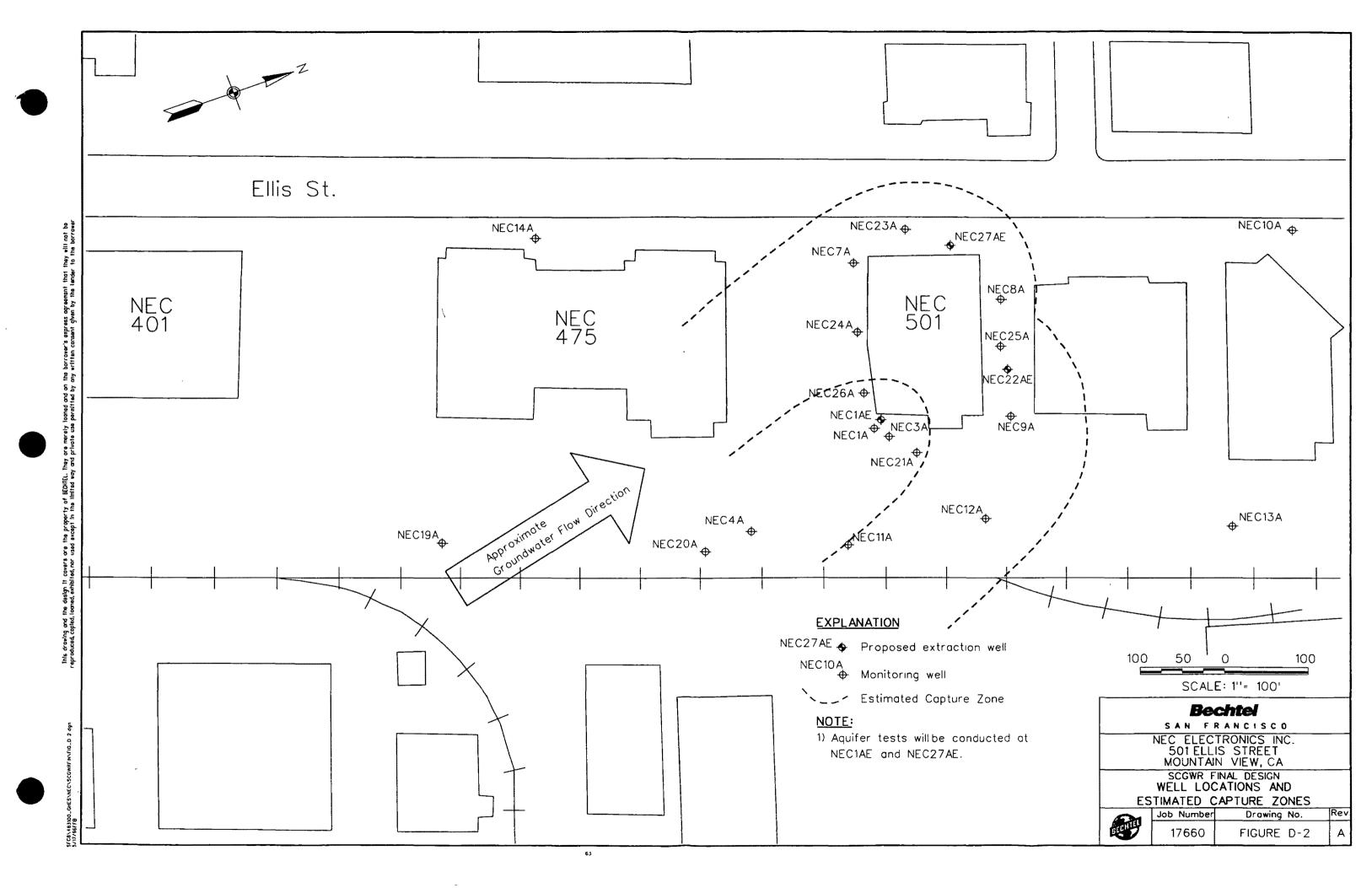
- II. Perform load-balancing circuit changes outside the normal occupancy/working schedule of the facility.
- III. Recheck loads after circuit changes during normal load period. Record all load readings before and after changes and submit test records.
- IV. Tolerance: Difference between phase loads exceeding 20 percent at any one panelboard is not acceptable. Rebalance and recheck as required to meet this minimum requirement.

END OF SPECIFICATION NO. 16470

17660

Drawing No.

FIGURE D-1



NOTES:

 Field modification of the well design may be necessary based on observation of the subsurface formation during drilling of the boring.

Bechtel

SAN FRANCISCO

NEC ELECTRONICS INC. 501 ELLIS STREET MOUNTAIN VIEW, CALIFORNIA SCGWR FINAL DESIGN

EXTRACTION WELL DESIGN

6	Job Number	Drawing No	Rev
	17660	FIGURE D-3	В

Table of Contents

Section			<u>Page</u>		
E1	INTRODUCTION				
·		Project Background Project Organization and Responsibility E1.2.1 Environmental Protection Agency, Region IX	E1-1 E1-2 E1-2 E1-2		
		E1.2.2 NEC Project Team E1.2.3 Contractors E1.2.4 Independent Quality Assurance Team	E1-5 E1-5		
E2	QUALITY ASSURANCE ACTIVITIES				
	E2.1	Construction Quality Assurance E2.1.1 Earthwork, Trenching, and Backfilling	E2-1 E2-2		
		E2.1.2 Concrete Placement E2.1.3 Underground Piping Installation E2.1.4 Treatment System Equipment and	E2-3 E2-4		
		Aboveground Piping Installation E2.1.5 Installation and Development of Extraction Wells	E2-4 E2-4		
	E2.2	_	E2-5 E2-5 E2-5		
•	E2.3	E2.2.3 Treatment System Monitoring	E2-6 E2-6 E2-6 E2-6 E2-6		
E3	FIELD	QUALITY ASSURANCE PROCEDURES	E3-1		
	E3.1	Sampling and Analysis	E3-1		
	E3.2	Test Control	E3-1		
	E3.3	Calibration and Maintenance	E3-1		
	E3.4	Handling, Storage, and Shipping	E3-2		
	E3.5	Sample Custody	E3-2		
	E3.6	Data Management	E3-2		
	E3.7	Performance and System Audits	E3-3		
	E3.8	Preventive Maintenance	E3-4		
	E3.9				
	E3.10	QA/QC Reports	E3-4		

Introduction

This Quality Assurance/Quality Control (QA/QC) Plan has been prepared by Bechtel Environmental, Inc. (Bechtel) for NEC Electronics Inc. (NEC). This QA/QC Plan has been prepared in fulfillment of the requirements of Section XVI.A of CERCLA §106 Administrative Order for Remedial Design and Remedial Action in the matter of the Middlefield-Ellis-Whisman (MEW) Study Area, U.S. EPA Docket No. 91-4 (Administrative Order).

This OA/OC Plan has been prepared to direct the performance of field work in support of the Source Control Groundwater Remediation (SCGWR) for the construction of a groundwater extraction and treatment system at the 501 Ellis Street property. It was prepared in accordance with the Guidance on EPA Oversight of Remedial Designs and Remedial Actions Performed by Potentially Responsible Parties, (April 1990), EPA/540/G-90/001.

The remainder of this section discusses the project background and project team organization. Section E2 of this plan describes construction quality assurance and inspection activities. Section E3 provides procedures for implementing field quality assurance activities such as sampling and analysis, calibration and maintenance, sample custody, data management, performance and system audits and corrective actions.

E1.1 PROJECT BACKGROUND

The 501 Ellis Street site is situated on a relatively flat tract of land that slopes gently to the north towards San Francisco Bay. The Bay is approximately two miles to the north, and the Santa Cruz Mountains are approximately six miles to the south. Drawing G-001 in Appendix B shows the location of the 501 Ellis Street site. The property is approximately two acres in size, consisting mainly of a paved open area. A large, single-story building occupies the western portion of the property. The surrounding properties are occupied primarily by other electronics industries.

The 501 Ellis Street site is currently owned by Renault and Handley Employees Investment Co. (Renault and Handley). The facility building is not occupied and utility connections such as telephone, electricity, and natural gas are no longer operational. The property is mostly covered by asphalt pavement and the building. Twenty groundwater monitoring wells are located on the 501 Ellis Street property site. Underground conduits and abandoned utility trenches are located along the north and east sides of the building. An elevated concrete pad is adjacent and attached Section E1 Introduction

to the north side of the building. The site plot plan (Drawing C-001, Appendix B) shows the location of the monitoring wells and the underground utilities at the 501 Ellis Street site.

The goal of SCGWR activities is to address elevated concentrations of volatile organic compound (VOC) groundwater concentrations beneath the 501 Ellis Street site. The groundwater extraction and treatment system is designed to effectively control and contain the source area identified at the southeastern end of the 501 Ellis Street building, and to complement the regional groundwater remediation program.

E1.2 PROJECT ORGANIZATION AND RESPONSIBILITY

An organization chart showing the lines of authority is provided in Figure E-1. A brief description of the responsibilities of the key team members is presented below.

E1.2.1 Environmental Protection Agency, Region IX

The Environmental Protection Agency, Region IX (EPA) is responsible for coordinating, monitoring, and overseeing compliance with the §106 Order and is responsible for approving the SCGWR Final Design.

E1.2.2 NEC Project Team

Project Coordinator

The Project Coordinator is the management representative for the project from Sheppard, Mullin, Richter and Hampton, legal counsel to NEC. The Project Coordinator is responsible for project team coordination, correspondence with EPA and other regulatory agencies, and consultant (Bechtel) overview and direction. The Project Coordinator has the authority, with NEC approval, to change the scope of the activities performed by the NEC Project Team.

NEC Coordinator

The NEC Coordinator is the NEC representative responsible for directing the environmental work at the 501 Ellis Street property. The NEC Coordinator is the liaison between the NEC Project Team, NEC management, and any NEC entities needed to facilitate the site work. In addition, the NEC coordinator is responsible for approving contracts and reimbursing Contractors (drilling, analytical laboratory testing, etc.), approving for disposal of both

Section E1 Introduction

hazardous and non-hazardous wastes generated during the project, signing hazardous waste manifests, and approving any changes to the scope and budget of the project.

Project Manager

The Project Manager is Bechtel's management representative for the project and has the authority and responsibility for overall project execution and quality, including scoping, staffing, scheduling, technical review and client communications.

Project Engineer

The Project Engineer reports to the Project Manager and reports functionally to his/her discipline manager. The Project Engineer's responsibilities include supervising the Preliminary and Final Design, coordinating design efforts among the various engineering disciplines, and technical review and approval of the design documents. The Bechtel Project Engineer is responsible for the execution of the project team's technical effort including planning, supervision of field investigations, design activities and remedial actions, evaluation of data, and preparation of reports.

Quality Assurance Manager (QAM)

The QAM reports directly to the Project Manager and reports functionally to his/her discipline manager. The QAM will review, monitor, audit, and evaluate performance of work for adherence to project procedures. The Project QA Manager is responsible for identifying problems that may arise in the quality of the work and will recommend corrective actions.

Quality Assurance Officer (QAO)

The QAO reports to Project Manager and functionally to his/her discipline manager. The QAO is responsible for developing and maintaining the Quality Assurance/Quality Control (QA/QC) Plan and for overseeing its implementation.

Safety and Health Supervisor

The Safety and Health Supervisor reports to the Project Manager and functionally to his/her discipline manager. The responsibilities of the Safety and Health Supervisor are to advise and oversee the Safety and Health Officer, to review Safety, Health, and Emergency Response Plan

Section E1 Introduction

(SHERP) and to ensure compliance with regulatory and Bechtel guidelines, policies, and procedures.

Safety and Health Officer

The Safety and Health Officer, interfaces with the Site Construction Manager on a regular basis and periodically reports to the Bechtel Safety and Health Supervisor. Responsibilities include: ensuring compliance with the requirements of the Occupational Safety and Health Administration (OSHA), Cal-OSHA, EPA, the project SHERP, and the client; providing Safety and Health support to the project as required by client requirements, Bechtel policy, and governing regulations; establishing and maintaining logs, records, reports, and files in accordance with Bechtel requirements as related to the health, safety and environmental aspects of the project; and approving Safety and Health reports and studies.

Site Construction Manager

The Site Construction Manager reports directly to the Project Manager and functionally to his/her discipline manager. The Site Construction Manager is responsible for all field management activities performed on the construction site. Specifically, the Site Construction Manager is responsible for providing liason between the client's site representative and the Bechtel organization; managing project construction costs and schedules; ensuring the quality of construction work on the project; managing the project field safety program; securing offsite services when required; and ensuring effective personnel management on the project.

Project Scientist

The Project Scientist reports to the Project Manager/Engineer and functionally to his/her discipline manager. The Project Scientist is responsible for planning and executing all environmental sampling and analysis. The Project Scientist will administer the subcontracts for laboratory analysis and is responsible for preparation of analytical data reports.

Data Manager

The Data Manager reports to the Project Scientist and reports functionally to his/her discipline manager. The Data Manager is responsible for all aspects of data management including tracking of analytical data generated during remedial activities, oversight of the project database, preliminary data evaluation, checking of data reduction calculations, and overall data vertication.

Project Geologist

The Project Geologist reports to the Project Manager/Project Engineer and functionally to his/her discipline manager. The Project Geologist is responsible for the quality of all geological work. The Project Geologist will prepare the specifications and administer the subcontracts for subsurface exploration, well installation, and aquifer testing.

E1.2.3 Contractors

The Contractors that will be involved in implementing the SCGWR Final Design include: a remedial action contractor (RAC), a subsurface exploration contractor (driller), and a California Department of Health Services (Cal-DHS) certified analytical laboratory. Survey services will also be provided by the RAC. The responsibilities of each Contractor is outlined in Table E-1. The Contractors contract directly with NEC.

The specifications for the procurement of the analytical laboratory will be prepared and submitted as part of the Construction Operation and Maintenance Plan (COMP). Specifications for the award of the remedial contract and the subsurface exploration contract are included in Appendix D of this document. The location of subsurface utilities and structures was completed in support of the base map preparation for the SCGWR Preliminary Design.

E1.2.4 Independent Quality Assurance Team

The Independent Quality Assurance Team (IQAT) will examine the work and test various material, procedures, and equipment of the RAC. Since it is anticipated that the RAC will be independent from the remedial design professional (e.g., Bechtel), it is proposed that qualified personnel from Bechtel be selected as the IQAT. Specific personnel will be designated in the Construction Operation and Maintenance Plan (COMP).

Ouality Assurance Activities

Construction inspection activities will be performed under the direction of the Project Engineer by field engineers and geologists to verify that the quality required by project drawings and specifications is maintained. Where applicable, the planning, completion, and documentation of inspection and test activities will be conducted according to standard Bechtel construction procedures.

Bechtel construction personnel will administer the RAC's on-site quality control programs by performing quality surveillance operations. Quality surveillance may involve monitoring the installation, inspection, examination, and testing activities of the RAC using applicable drawings and specifications. As required, field engineers and geologists will inspect and document installation, testing, and operation and maintenance activities during the process of construction and operation, and after work is completed.

The following activities will be monitored under this program: construction quality assurance, compliance monitoring quality assurance, and safety and health. The QA tests and inspections associated with each of these are discussed below. Additional tests and inspection requirements for each element of remedial work not discussed herein are specified in detail in the construction specifications provided in Appendix D.

E2.1 CONSTRUCTION QUALITY ASSURANCE

This section describes the QC inspections, sampling, testing, and review that will be performed so that the groundwater extraction and treatment system is constructed in accordance with specifications and meets the design criteria. A summary of tests and inspection requirements are provided in Table E-2. Table E-2 also identifies the references where a detailed description of quality control procedures can be found.

To verify and demonstrate that design requirements are properly incorporated during the construction of the treatment system, a specific quality assurance program consisting of inspections and verification tests will be performed. The program is divided into five categories: 1) earthwork, trenching and backfilling, 2) concrete placement, 3) underground piping and installation, 4) equipment, system, and aboveground piping installation, and 5) well installation, development and aquifer testing.

The types of quality assurance activities to be performed during the construction phase are:

- <u>Field Inspections</u>. Field inspections will be performed by the Site Construction Manager and/or IQAT. Inspections are primarily visual examinations, but may include measurements and assessments of equipment and techniques employed, and final products. The purpose of these inspections is to demonstrate that a specific guideline, specification, or procedure for the activity is successfully completed;
- <u>Field Testing.</u> Field testing will be performed by the IQAT in accordance with specified procedures. Field tests will be performed on samples or in-situ portions of the as-built treatment system to assess whether construction performance meets project requirements;
- <u>Laboratory Testing.</u> Laboratory testing will be performed by offsite laboratories on samples of materials to be used for construction. Laboratory testing results will be used to characterize materials to confirm performance;
- <u>Surveying</u>. Surveying will be performed to establish horizontal and/or vertical coordinates of the treatment system, as appropriate; and
- <u>Receiving Inspections.</u> Receiving inspections will be performed by the Site Construction Manager. The inspections include, as necessary, visual examinations and measurements of materials obtained from suppliers prior to installation. The purpose of these inspections is to verify that the materials used meet specifications and are not defective.

The inspections and verification testing necessary to control, verify, and document satisfactory work performance for the five construction categories are discussed below.

E2.1.1 Earthwork, Trenching, and Backfilling

Quality assurance activities that will be performed during earthwork activities include:

- 1) Inspection and logging, as necessary, of excavated and finished subgrade;
- 2) Inspection of fill materials; and
- 3) Laboratory testing of fill materials.

Imported and excavated site materials will be used for backfill. Visual inspections of the excavated material will be performed by the construction personnel and by members of the IQAT to detect the presence of organic matter and irreducible matter larger than two inches.

Laboratory testing of backfill materials will be performed to document engineering properties and to verify the acceptability of the material for use in construction. The laboratory tests will include the determination of the relationship between moisture content and density in accordance with ASTM D 1557, performed at a frequency of one test per day when fill is being placed. Grain-size will be also be determined at a frequency of one per load of backfill material using ASTM Method D 422.

In-place compaction will be measured once per lift of backfill placed by using ASTM D 1557. At least one test will be performed for every 500 cubic yards of area fill or for every 100 lineal feet of trench per lift. The moisture content of the compacted fill will also be determined as required. At least one test will be performed. In addition, drainage fill materials shall conform to ASTM D 448.

During placement of fill materials, visual inspection of the following will be performed and documented:

- Type and quantity of earthwork equipment used;
- Coverage and number of passes made by compaction equipment; and
- Lift thickness.

E2.1.2 Concrete Placement

The following inspection and tests will be performed by the IQAT during concrete placement activities to determine adherence to specifications: slump test, strength test and rebar placement. Slump will be tested at a frequency of once per batch of concrete mixed or once per day. Samples of concrete poured to construct the treatment pad will be collected according to procedures outlined in the specification. Samples will be collected at a rate of one of every 100 cubic yards of concrete or once per day. Samples will be tested for compressible strength using ASTM C94.

E2.1.3 Underground Piping Installation

A site inspection and examination (one time) of the underground piping installation will be conducted as part of the construction QA oversight activities to determine adherence to drawings and specifications. Testing of each pipe system will also be conducted in accordance with American Society of Mechanical Engineers (ASME) requirements.

E2.1.4 Treatment System Equipment and Aboveground Piping Installation

The treatment system will be visually inspected and field tested for proper installation and operation. Treatment system components will also be subject to testing by the manufacturer and receiving inspections by the Site Construction Manager. Testing will be performed in accordance to the manufacturer's standard procedures and as outlined in specifications, Appendix D.

Complete testing of control panels will be conducted prior to shipment to verify correct wiring and proper operation of all instruments and devices. General instruments and controls will also be tested for compliance with specifications.

In addition to tests conducted at the manufacturer's facility, each control valve will be field tested to verify mechanical performance of the valves and to check for any visible or audible leakage or other malfunction.

Each aboveground pipe system will also be visually inspected and field tested for adherence to drawings, listed standards (e.g., ASME requirements), and specifications.

E2.1.5 Installation and Development of Extraction Wells

Boring Logs. A complete log of conditions encountered during drilling will be maintained by the project geologist using the Unified Soil Classification System. A geologic boring log will be used to record field observations. At a minimum, the following information will be recorded in the field logbook: boring identification, boring location, sample depths (if applicable), color of soil samples, grain size of soil samples, relative percent of grain sizes, estimated relative moisture content, depth where groundwater is first encountered, variations in drilling rates and rig behavior, and the signature of the project geologist.

<u>Installation Technique.</u> Extraction well installation will be performed in accordance with procedures outlined in Appendix D of this document for Drilling, Well Installation, Well Development, and Aquifer Testing.

Well Details (Construction and Instrumentation). Extraction wells will be installed in accordance with the well details provided in Section 3, and Appendix D of this Final Design.

Aquifer Testing. Aquifer testing will be performed in accordance with the requirements provided in Appendix D of this Final Design.

E2.2 COMPLIANCE QUALITY ASSURANCE

E2.2.1 Waste Management

Residual wastes such as excavated trench materials, purge and development water, decontamination water and construction debris generated during the construction of the SCGWR treatment system will be handled, stored, tested, and disposed in accordance with applicable regulations as specified in the Waste Management Plan, Appendix F. Sample collection procedures, analytical methods, and QA/QC protocols will be specified in the Sampling and Analysis Plan, to be submitted as part of the COMP.

E2.2.2 Excavated Material

All excavated soil will be stockpiled. Each stockpile will be sampled and the sample will be analyzed by a state-certified laboratory. One sample will be collected for every 25 cubic yard of material contained in a stockpile. The laboratory shall analyze soil samples for VOCs using the EPA Method 8010 analyte list, modified to include cis-1,2-dichlorothene (cis-1,2-DCE) and 1,1,2-trichloro-1,2,2-trifluoroethane (Freon 113). Soil that is non-contaminated, (i.e., below cleanup levels) will be used as backfill on-site or if backfill requirements have been met disposed of in a municipal landfill.

If the laboratory analysis results indicate that the soil is contaminated (i.e., VOCs are above cleanup levels) the excavated soil will be transported to a local municipal landfill for disposal.

If imported backfill material is required then one sample will be collected from each load of imported backfill material delivered to the site. The sample of backfill materials will be analyzed

for VOCs using the modified EPA Method 8010 analyte list and antimony, arsenic, cadmium and lead.

E2.2.3 Treatment System Monitoring

Water levels will be measured and groundwater samples will be collected to verify attainment of the proposed capture zone and to demonstrate the effectiveness of the the SCGWR system. Treatment system monitoring will be performed in accordance with the Site Environmental Monitoring Plan ([SEMP], Section 6 of the Final Design) and the Sampling and Analysis Plan that will be submitted as part of the COMP.

E2.3 SAFETY AND HEALTH

Dust generation, noise level, and trench excavation monitoring will be monitored to document safety and health practices during construction of the treatment system and to document adherence to procedures outlined in the Safety and Health Plan.

E2.3.1 Dust Control

Dust control will be monitored visually for dust generation on a daily basis to determine whether the engineering controls such as spraying and covering stockpiles are adequately controlling emissions.

E2.3.2 Noise Level

The noise level will be monitored twice daily so that proper hearing protection is recommended and used by field personnel.

E2.3.3 Excavation Monitoring

During trench excavation activities, a photoionization detector will be used to monitor the presence of volatile organic vapors.

Direct monitoring of VOC's using a HNU photoionization detector will be performed during excavation activities. If concentrations are consistently high, personal monitoring of the breathing zone is to be performed for personnel at highest risk (dozer driver, auger operator). If levels are greater than the recommended exposure levels, respiratory protection is to be worn. If

levels are consistently low, the monitoring frequency may be reduced. Various chemical specific tubes may also be used for approximating the concentration of other detected hydrocarbons.

Regular monitoring for flammable vapors is not proposed due to the low concentrations of compounds detected in the soil. However a flammable gas and oxygen meter is to be available on-site for use when there is an appropriate change in soil conditions or other unexpected condition requires monitoring (e.g., interception of underground utility).

Field Quality Assurance Procedures

E3.1 SAMPLING AND ANALYSIS

Sample procedures will be prepared describing sampling techniques, sample frequency, and associated equipment. Sampling procedures will address the following topics: selection of sample locations; methods of collection including type of equipment; frequency of sampling; type and volume of sample containers; special conditions for sample preparation to avoid contamination; holding times and preservation methods; sample shipment procedures; methods to be used for sample analysis; decontamination procedures and sample custody procedures.

Analytical QA/QC for the laboratory will be based on the laboratory's specific QA/QC procedures, EPA's analytical methodologies, and/or ASTM methods. Standard SW-846 methods and QC procedures will be followed and analytical results will be reported in the laboratory's standard report format. Validation data will be held on file at the laboratory. Field QC and laboratory QC checks will be employed to evaluate the performance of field and laboratory analytical procedures.

E3.2 TEST CONTROL

Field testing will be performed during construction activities. In-situ testing performed during remedial activities will be performed in accordance with procedures established for that purpose (in the appropriate design specification and Sampling and Analysis Plan [SAP]). Such procedures include provisions for ensuring that data obtained are of known and defensible quality.

The Project Engineer will review and approve the material and RAC requisitions to ensure that the required tests are specified to be performed by the supplier or RAC. The Site Construction Manager will verify that required tests are performed satisfactorily and that test procedures and test reports are reviewed by the appropriate personnel.

E3.3 CALIBRATION AND MAINTENANCE

Equipment for measuring and testing will be used during SCGWR construction and construction inspection. Calibration frequency and standards will be specified for each major piece of equipment. Normally, the manufacturer's calibration instructions are followed for calibration, calibration checks and maintenance. Procedures for control and maintenance measuring and

testing equipment include: identification of equipment, calibration record requirements, corrective action requirements when equipment is not in calibration, and specific calibration and calibration check instructions. Reference calibration standards will be certified to the National Bureau of Standards or other acceptable standards. Appropriate documentation will be maintained.

The QAO will verify that the instruments and other devices used for inspection and testing at the site have been calibrated. Calibration and precision requirements for water level measurements, elevation measurements, pH, conductivity, temperature, and water flowrate will be specified in the QAPjP. Calibration and precision requirements for the photoionization detector, noise level meter, and combustible gas indicator will be addressed in the SHERP. The QAPjP and the SHERP will be submitted as part of the COMP.

E3.4 HANDLING, STORAGE, AND SHIPPING

The Site Construction Manager or designee will verify that the receipt, storage, and installation of construction materials are in compliance with project requirements. Such requirements will be made available to field personnel through documents such as the manufacturer's instructions and manuals or field procedures. The handling, storage, and shipping of samples will be described in the SAP.

E3.5 SAMPLE CUSTODY

The purpose of these procedures is to assure the following:

- The integrity of samples is maintained during their collection, transportation, and storage before analysis; and
- Proper management of residual material generated during field activities.

All samples for laboratory analysis will be collected and handled in accord with EPA chain-of-custody guidelines as prescribed in EPA's *NEIC Policies and Procedures*, EPA-330/9-78-001-R. Sample custody procedures are outlined in detail in the QAPjP.

E3.6 DATA MANAGEMENT

Thorough field logs will be kept by field personnel to document field activities. The field logs will indicate, at a minimum, the construction activities performed, site visitors, materials and

equipment leaving and entering the site, samples collected, tests and inspections conducted, and any unusual conditions encountered. Records of samples collected, data measurements taken, and observations of events and conditions which could affect data quality will also be recorded in logbooks. These logbooks will provide sufficient data to enable participants to: reconstruct events that occurred during the data collection process, and to help qualify data.

All original data collected in the field are permanent records and will be recorded in field logbooks, sample identification tags, chain-of-custody records and other documents in waterproof ink. All of these documents will be signed and dated by the originator. Errors will be corrected by crossing a single line through the error and entering the correct information. Corrections will be initialled and dated by the person making the correction.

Specific guidelines for analytical data reduction, validation, and reporting will be provided in the QAPjP.

E3.7 PERFORMANCE AND SYSTEM AUDITS

Audits will be performed by the QAM or designee. Both system and performance audits will be performed as early in the field and analytical programs (within the first week of field sampling and analysis) as is reasonably possible to ensure that any developing problems are identified and corrected at the earliest possible time. After the initial audit, audits will be performed at a frequency determined by the QAM depending upon the project activity.

System audits will include confirming the proper calibration of testing equipment, verifying recordkeeping activities; verifying the collection of field measurements; verifying sample collection, shipping, and chain-of-custody procedures; verifying decontamination of equipment; verifying internal QA/QC programs of analytical and physical testing laboratories; periodically inspecting field tasks such as surveying, drilling, aquifer testing, and soil and water sampling; and verifying record maintenance for measurements and quantities where appropriate.

Performance audits will focus on the performance of the laboratory analytical program. QC measures such as the inclusion of spikes, blanks, and duplicates in the analytical program will be reviewed.

E3.8 PREVENTIVE MAINTENANCE

All equipment will receive routine maintenance checks in order to minimize equipment breakdowns in the field. Maintenance checks will generally coincide with calibration checks. Any equipment found to be operating improperly will be taken out of service, and a note stating the time and date of this action will be made in a field logbook. The equipment will be repaired, replaced or recalibrated, as necessary, and the time and date of its return to service will also be recorded. A schedule of field equipment maintenance will be provided in the QAPiP.

E3.9 CORRECTIVE ACTIONS

As indicated in Section 1, the Project Quality Assurance Supervisor (QAM) will be responsible for the identification of problems and implementation of corrective actions. If the Project Manager, Project Engineer or project staff becomes aware of any problems in sample collection or analysis he/she will immediately notify the QAM who will decide upon the appropriate action to be taken to correct the problem.

Corrective actions may include one or more of the following:

- Measurements may be repeated to check the error;
- Calibrations may be checked and/or repeated;
- Instrument or measuring device(s) may be replaced or repaired; and
- New samples may be collected, and/or samples may be reanalyzed.

Appropriate corrective actions will be determined on a case by case basis. A discussion of any corrective actions taken will be included in appropriate reports.

E3.10 QA/QC REPORTS

The results of QA/QC tests and inspections will be evaluated and reported as part of the Quarterly Progress Reports to EPA. The reports will include document implementation of the QA/QC program including significant QA problems, recommended solutions, and/or corrective actions implemented.

These reports will include:

Periodic assessment of measurement data accuracy, precision and completeness;

- Results of performance audits;
- · Results of system audits; and
- Significant QA problems and recommended solutions.

TABLE E-1

CONTRACTORS

CONTRACTOR*	TYPE OF WORK
Subsurface Exploration (Driller)	 Drilling and soil sampling; Extraction well installation and well development; and Aquifer testing.
Remedial Action Contractor	 Site clearing and restoration; excavating, backfilling, and compacting soil; Installation, testing, and startup of the treatment system; Hauling soil and construction debris to landfill; and Surveying.
DHS Certified Analytical Laboratory	Testing soil and water for volatile organic compounds

^{*} Contractors will be identified after a competitive bid and selection process or sole source contract when authorized by NEC.

DHS = Department of Health Services

TABLE E-2 SUMMARY OF QA/QC ACTIVITIES

Item Description

QA/QC Testing/Inspections Specification or Drawing [1]

Procedure or Method

Test/Inspection Performed By

Frequency

Reference

۱.	Construction QA							
1	Earthwork, Trenching and Backfilling							
	Moisture Content	Adherence to specification	02200	2% of optimum	Contractor	As Required	Appendix D	
	Compaction	Adherence to ASTM method and specification	02200	ASTM D1557	Contractor	Every 500 cy of area fill or every 100 lineal ft of trench per lift		
	Granular Material Size	Adherence to ASTM method and specification	02200	ASTM D448	·Contractor	Once per load		
2	Concrete							
	Slump	Adherence to specification	03300	4 inch maximum	Contractor	Every batch or once per day	Appendix D	
	Strength	Adherence to specification	03300	ASTM C94	Contractor/Engr.	Every 100 cy or once per day	1	
	Rebar	Adherence to specification	03300	ASTM A615	Contractor	During construction	1	
	Installation Technique Pressure Testing	Adherence to drawings and specification Adherence to drawing and	C-004, M-003, 15410 M-001, 15410	ASME B31.3	Contractor/Engr	Each system Each system	Appendices E C, & D	
	Pressure Testing		M-001, 15410	ASME B31.3	Contractor/Engr	Each system	1 -/	
		specification						
	Pipe Placement	Adherence to drawings and specification	C-001, M-001, 15410	ASME B31.3	Contractor	During construction		
Eo	quipment System Installation a	nd Aboveground Piping		,	· —		•	
	Manufacturer Site	Adherence to drawings,	M-001, 15010,	ASME B31 3, ASTM	Manufacturer	Each system	Appendices E	
	Inspection (Electrical	specifications, and pipe	15410	D-1785, D-3350, UL-			C, & D	
	and Markaniant	pressure test		50, 61, NFPA-NEC				
	and Mechanical)					·		
		ment and Aquifer Testing						
5	Well Installation, Developi			ASTM D-1586	Engineer	During Drilling	Annendix D	
, ;	Well Installation, Developing Logs	Adherence to ASTM method	02230	ASTM D-1586	Engineer Contractor/Engr	During Drilling	Appendix D	
	Well Installation, Developi Boring Logs Installation Technique	Adherence to ASTM method Adherence to specification	02230	Part 3 of Specification	Contractor/Engr	During Construction	Appendix D	
· · · · · · · · · · · · · · · · · · ·	Well Installation, Developing Logs	Adherence to ASTM method Adherence to specification					Appendix D	

TABLE E-2 cont SUMMARY OF QA/QC ACTIVITIES

Procedure or

Specification or

	Item Description	Testing/Inspections	Drawing [1]	Method	Performed By	Frequency	Reference
В. Со	mpliance Monitoring QA	•			994 M		
1.	Waste Management	Adherence to WMP and SAP	NA	COMP	Engineer	During Construction	Appendix F, COMP
2	Backfill Material	Adherence to SAP	NA	COMP	Engineer	Per Load	COMP
3	Trench Excavation	Adherence to WMP and SAP	NA	СОМР	Engineer	Every 50 cy	Appendix F, COMP
4	Treatment System	Adherence to SAP	NA	COMP	Engineer	As Required	Section 6, Appendix F; COMP
5.	Discharge Permit	Adherence to Permit Requirements	NA	СОМР	Engineer	Per Discharge Event	Permit No 901, COMP
C. He	alth and Safety						
1.	Dust Control	Visual for dust generation	NA	HSP	Engineer	Daily	HSP
2.	Noise Level	Noise Monitoring	NA	HSP	Engineer	Twice Daily	HSP
3	Trench Excavation Monitoring	Photoionization detector	NA	HSP	Engineer	Every 50 cy	HSP

Abbreviations

ASME = American Society of Mechanical Engineers

COMP = Construction Operation and Maintenance Plan

HSP = Health and Safety Plan

NFPA-NEC = National Fire Protection Association - National Electric Code

SAP = Sampling and Analysis Plan

WMP = Waste Management Plan

ASTM = American Society of Testing and Materials

Test/Inspection

Engr = Engineer

NA = Not Applicable

QA/QC = Quality Assurance /Quality Control

UL-Underwriter's Laboratories

Notes

[1] Specifications are five digit numbers such as 02200; drawings are alphanumeric with a single letter and three numbers such as C-004

OA/OC

Table of Contents

Section			<u>Page</u>			
F1	INTRODUCTION					
	F1.1	Purpose	F1-1			
	F1.2	Project Background	F1-1			
F2	TYPES OF ACTIVITIES GENERATING WASTE					
	F2.1	Installation of Extraction and Monitoring Wells	F2-1			
	F2.2	· · · · · · · · · · · · · · · · · · ·	F2-1			
	F2.3	Installation of Treatment System	F2-1			
F3	MANAGEMENT OF WASTE MATERIALS					
	F3.1	Asphalt and Concrete Materials	F3-1			
	F3.2	Excavated Soil Materials	F3-1			
	t	F3.2.1 Non-Contaminated Soil	F3-1			
		F3.2.2 Contaminated Soil	F3-2			
	F3.3	Drill Cuttings	F3-2			
	F3.4	_	F3-2			
	F3.5	Decontamination Fluids, Disposable Equipment, and Personal				
		Protective Equipment	F3-2			
	F3.6	Construction Debris	F3-3			
F4	SAMPLING AND ANALYSIS					
	F4.1	Sampling of Excavated Soils	F4-1			
	F4.2	Drill Cutting Samples	F4-1			
	F4.3	Development, Purge, and Decontamination Water Samples	F4-1			
F5	DOC	UMENTATION OF WASTE MANAGEMENT PRACTICES	F5-1			
		TABLES				

Waste Management Matrix

F-1

Introduction

This Waste Management Plan (WMP) was prepared by Bechtel Environmental, Inc. (Bechtel) for NEC Electronics Inc. (NEC). This plan was prepared in support of the Source Control Groundwater Remediation (SCGWR) Final Design for the construction of a groundwater extraction and treatment system at the 501 Ellis Street property.

F1.1 PURPOSE

The purpose of this plan is to provide guidelines for the characterization, handling, storage, and disposal of liquid and solid wastes generated from activities associated with the construction of the SCGWR system.

Section F2 of this plan describes activities expected to generate waste. Section F3 describes the methods to be used for managing the various types of wastes which are generated. Section F4 describes the sampling and analysis that will be performed to characterize and manage construction derived wastes. Section F5 describes procedures for documenting waste management activities.

F1.2 PROJECT BACKGROUND

The 501 Ellis Street site is situated on a relatively flat tract of land that slopes gently to the north towards San Francisco Bay. The Bay is approximately two miles to the north, and the Santa Cruz Mountains are approximately six miles to the south. Drawing G-001 shows the location of the 501 Ellis Street site. The property is approximately two acres in size, consisting mainly of a paved open area. A large single-story building occupies the western portion of the property. The surrounding properties are occupied primarily by other electronics industries.

The 501 Ellis Street site is currently owned by Renault and Handley Employees Investment Co. (Renault and Handley). The facility building is not occupied and utility connections such as telephone, electricity, and natural gas are no longer operational. The property is mostly covered by asphalt pavement and the building. Twenty groundwater monitoring wells are located on the 501 Ellis Street property site. Underground conduits and abandoned utility trenches are located along the north and east sides of the building. An elevated concrete pad is adjacent and attached to the north side of the building. The site base map (Drawing G-002) shows the location of the monitoring wells and the underground utilities at the 501 Ellis Street site.

Soil remediation was conducted at the 501 Ellis property in 1991. The soil remediation was conducted to remove soils with TCE concentrations greater than the cleanup standard of 0.5 mg/kg. As a result of the soil remediation, only very low levels of volatile organic compounds

(VOCs) remain in soils at the 501 Ellis Street property. Hazardous wastes were not generated during the soil remedial activities in 1991 and are not anticipated to be generated during the groundwater source control remediation activities.

The goal of SCGWR activities is to address elevated concentrations of volatile organic compound (VOC) groundwater concentrations beneath the 501 Ellis Street site. The groundwater extraction and treatment system is designed to effectively control and contain the source area identified at the southeastern end of the 501 Ellis Street building, and to complement the regional groundwater remediation program.

Types of Activities Generating Waste

This section describes the field activities that are expected to generate waste during the construction of the SCGWR.

F2.1 INSTALLATION OF EXTRACTION AND MONITORING WELLS

Two 6-inch extraction wells (e.g., NEC1AE) will be installed as part of the SCGWR groundwater extraction and treatment system. During well installation, drilling will be performed using a hollow stem auger and the wells will be developed by pumping and surging to remove sediment. In addition to well installation, several monitoring wells may also be abandoned. During abandonment, the protective surface casings, posts, and concrete pads will be removed and the borehole will be backfilled with grout.

These activities will generate waste in the form of drill cuttings; polyvinyl chloride (PVC) casings; well development and purge waters; used personal protective equipment (PPE), and disposable equipment and cleaning fluids.

F2.2 INSTALLATION OF CONVEYANCE PIPING

Eight hundred and ten feet of conveyance piping will be installed from extraction wells to the treatment system and from the treatment system to the discharge outlet. During the construction of the groundwater piping system, approximately 175 cubic yards of excavated material will be generated. Wastes generated during the construction of the groundwater piping system can be broadly grouped into these categories: non-contaminated soils; contaminated soils; decontamination fluids, and miscellaneous construction waste and debris.

F2.3 INSTALLATION OF TREATMENT SYSTEM

Construction debris and waste will be generated during the construction of the groundwater treatment system. Construction debris and waste generated may include: concrete pad, concrete partition, street curb, and chain-linked fence removal; fence and gate installation; and miscellaneous piping installation. All materials generated as part of this activity are considered construction related waste and debris. No contaminated or hazardous materials are expected to be generated during the conduct of this activity.

Management of Waste Materials

This section describes how waste materials generated will be handled and managed. Table F-1 summarizes the collection, storage, sampling and analysis and disposal guidelines for each type of waste generated as part of the construction of the SCGWR groundwater extraction and treatment system.

F3.1 ASPHALT AND CONCRETE MATERIALS

Excavated asphalt and concrete materials will be segregated. Asphalt and concrete materials will be placed directly onto trucks for immediate off-site disposal or stockpiled separately in a designated on-site area for later disposal. Asphalt and concrete materials will be transported and disposed at a municipal landfill.

F3.2 EXCAVATED SOIL MATERIALS

It is estimated that 175 cubic yards of soil will be excavated during installation of the conveyance piping route. Excavated materials will be stockpiled, sampled, and analyzed prior to use as on-site backfill material or off-site disposal. Samples of excavated soil will be analyzed for VOCs by EPA Method 8010 to determine whether the soil may be used as backfill or has to be disposed. The EPA Method 8010 shall be modified to include cis-1,2-dichloroethene (cis 1,2-DCE) and 1,1,2-trichloro-1,2,2-trifluoroethane (Freon 113). One sample will be collected from every 25 cubic yards of excavated material.

Any excess excavated soil material (i.e., dirt, gravel, rock, etc.) that can not be used as backfill because it exceeds the volumetric backfill demand or exceeds an allowable VOC concentration is designated as excess excavated soil material. Excavated soil materials, including excess excavated soil material, will be managed and disposed of as described in the following subsections:

F3.2.1 Non-Contaminated Soils

Laboratory analyses for VOCs will establish whether a soil stockpile is non-contaminated or contaminated. If the sample results determines that a stockpile is non-contaminated (i.e., below the cleanup level for VOCs) the soils may be used as backfill or be transported to a local landfill for disposal.

As an example, Kirby Canyon Sanitary Landfill located in San Jose, California can accept the anticipated volume of non-contaminated solid waste that will be generated during construction. No permit application will have to be filed. However, advance notice will be required disclosing the non-contaminated nature of the material.

F3.2.2 Contaminated Soils

If the laboratory analyses for VOCs determines that a stockpile is contaminated (i.e., above the cleanup levels) the soils will be disposed of off-site. The contaminated soils from a stockpile will be loaded into special containers or end dumps for disposal. Contaminated materials will be disposed at a Class II or Class I landfill, as appropriate.

F3.3 DRILL CUTTINGS

Drill cuttings will be placed in 55-gallon drums as generated and stored on-site in a designated area. The stored drums will be identified with the borehole from which the drill cuttings originated. A sample for each of the boreholes will be collected from the drummed drill cuttings. The samples of drill cuttings will be analyzed for VOCs by EPA Method 8010 to determine whether the cuttings can be used as backfill or have to be disposed. The EPA Method 8010 shall be modified to include cis 1,2-DCE and Freon 113. If non-contaminated, drill cuttings will be combined with clean excavated soil material for either reuse as backfill or for disposal. If the drill cuttings are contaminated, they will be segregated and disposed at a Class II and/or Class I landfill, as appropriate.

F3.4 WELL DEVELOPMENT AND PURGE WATER

Well development and purge water will be collected in 55-gallon drums or polyethylene tanks and temporarily stored on-site. A sample of the development water will be tested prior to discharge to the City of Mountain View municipal sewer system in accordance with the requirements of NEC's Liquid Waste Discharge Permit No. 901.

F3.5 DECONTAMINATION FLUIDS, DISPOSABLE EQUIPMENT AND PERSONAL PROTECTIVE EQUIPMENT

Decontamination fluids will be collected in clean containers or in temporary storage tanks at a designated temporary storage area. Upon completion of the sampling activity, the wash water will be allowed to stand for at least 30 minutes to permit suspended solids to settle. The decanted water will be collected in 55-gallon drums or polyethylene tanks and temporarily stored on-site or discharged directly into the groundwater treatment system for disposal. A sample of the fluids will be tested for the presence of chemicals. A sample of the drummed decontamination fluids will be collected and analyzed for halogenated volatile organic compounds (EPA 8010) and aromatic volatile organic compounds (EPA 8020). Sediments will be combined with the drill cuttings for disposal.

During construction operations, disposable equipment and materials and used personal protective equipment that have contacted potentially contaminated materials will be collected in double-bagged containers and placed in refuse dumpsters for ultimate disposal at a municipal landfill.

Non-hazardous solid waste including excess excavated material and construction will be disposed off-site at a local municipal landfill. Decontamination water will be temporarily contained in an on-site, 6500-gallon portable polyethylene tank, sampled to verify that it met discharge requirements, and discharged at the on-site sewer inlet in accordance with a City of Mountain View discharge permit.

F3.6 CONSTRUCTION DEBRIS

Non-contaminated construction debris will be collected and placed in refuse dumpsters for ultimate disposal at a municipal landfill.

Sampling and Analysis

This section presents the procedures for sample collection and analysis of waste materials.

F4.1 SAMPLING OF EXCAVATED SOILS

At least one sample of excavated soil will be collected from every stockpile and/or one sample will be collected for every 25 cubic yards of excavated material. The samples will be analyzed for VOCs by a state-certified laboratory using EPA Method 8010 modified to include cis 1,2-DCE and Freon 113.

F4.2 DRILL CUTTING SAMPLES

A grab sample will be collected from drummed drill cuttings generated from each borehole and analyzed for VOCs using EPA Method 8010. The EPA Method 8010 will be modified to include cis 1,2-DCE and Freon 113.

F4.3 DEVELOPMENT, PURGE, AND DECONTAMINATION WATER SAMPLES

Grab samples of development, purge, and decontamination water will be collected prior to discharge. Samples will be analyzed for VOCs using EPA Method 8010/8020 as outlined in NEC's existing City of Mountain View Liquid Waste Discharge Permit No. 901.

Documentation of Waste Management Practices

Recording information in the field logbook will be the primary means of documenting waste management practices in the field. The Site Construction Manager or his designee will be responsible for keeping the daily field logbook, documenting site activities relevant to waste generation, and recording waste management information, including:

- · Activity generating waste and location;
- Date, quantity, and type of waste generated;
- · Description of how waste was collected;
- Description of waste containers and how labeled (if applicable);
- Description of the temporary storage area and location, including containment and security features;
- Description of any samples of waste taken, time and date of collection, sample designations and other relevant sample information;
- Description of any subsequent on-site treatment, reuse, discharge or disposal, including relevant dates, quantities, locations and rationale for actions taken;
- Listing of other relevant documents (e.g., analytical results) pertaining to the waste.

The logbook and supporting documents (copies of analytical results, approved waste profiles, manifests, etc.) will be maintained in the project files.



	Waste Type	Collection/Storage	Sampling and Analysis	Disposal
1	Asphalt Materials	Asphalt materials will be segregated and placed directly onto trucks for offsite disposal or stockpile separately for later disposal	None.	Dispose at a municipal landfill
2.	Excavated Trench Soils a) Non-Contaminated Soil	Use conventional earthmoving equipment and temporarily stockpile onsite.	Collect one sample per 25 cubic yards of soil. Analyze sample for VOCs by EPA Method 8010, modified to include cis 1,2-DCE and Freon 113	Use as backfill material or dispose in municipal landfill.
	b) Contaminated Soil	Use conventional earthmoving equipment and temporarily stockpile onsite.	Collect one sample per 25 cubic yards of soil. Analyze sample for VOCs by EPA Method 8010, modified to include cis 1,2-DCE and Freon 113	Dispose at a Class II landfill or transport under manifest and dispose at a licensed RCRA facility.
3.	Drill Cuttings a) Non-Contaminated	Collect in 55-gallon drums; each drum dated and marked with boring number.	Sample and analyze a drum from each borehole for VOCs by EPA Method 8010, modified to include cis 1,2-DCE and Freon 113.	Use as backfill material or dispose in municipal landfill
	b) Contaminated	Collect in 55-gallon drums; each drum dated and marked with boring number.	Sample and analyze a drum from each borehole for VOCs by EPA Method 8010, modified to include cis 1,2-DCE and Freon 113.	Dispose at a Class II landfill or transport under manifest and dispose at a licensed RCRA facility.
4.	Well Development, Purge Water, and Decontamination Fluids	a) Collect in 55-gallon drums or polyethylene tank; each dated and marked with boring number. or b) Discharge directly to groundwater treatment system	a) Sample and analyze a drum from each borehole for VOCs by EPA Method 8010, modified to include cis 1,2-DCE and Freon 113 or b) Collect and analyze samples according to groundwater treatment system requirements.	a) Discharge to sanitary sewer or b) Discharge directly to groundwater treatment system
5	Disposable Equipment and Personal Protective Equipment	Double-bag and place in refuse dumpsters.	None	Dispose at a municipal landfill.
6.	Construction Debris	Place in refuse dumpsters	None.	Dispose at a municipal landfill.

DRAFT LETTER

Mr. Gary Leinweber
Environmental Safety Manager
City of Mountain View
Fire Department
1000 Villa Street
Mountain View, CA 94041-1295

Subject: Amendment of Liquid Waste Discharge Permit ID #901

NEC Electronics Inc.

Dear Mr. Leinweber:

As you are aware, NEC Electronics Inc. (NEC) currently possesses a liquid waste discharge permit for the release of purged groundwater generated during the periodic sampling of its monitoring wells (a copy is attached). This groundwater monitoring program represents one of numerous remedial activities that has been, or is being, conducted by NEC. Currently, NEC is in the process of designing and constructing a localized groundwater extraction and treatment system at its former 501 Ellis Street facility. This work is being performed under oversight by the U.S. EPA (EPA) and in coordination with the Middlefield-Ellis-Whisman (MEW) regional groundwater remediation program. The preliminary design has been recently approved by EPA, and NEC is proceeding with the development and submittal of the final design package.

The proposed design for this system consists of a network of 3 extraction wells screened in the A aquifer. Groundwater, containing volatile organic compounds (VOCs), will be pumped from the wells into a holding tank and remediated through a liquid granular activated carbon (GAC) treatment system located on the property. The total flow rate of the treatment system effluent is anticipated to be an average of 1.5 to 2 gallons per minute. Maximum flow rate is not expected to exceed 10 gallons per minute. In consideration of the relatively low flow rates, NEC is proposing to discharge the treated water to the City's Public Operated Treatment Works (POTW).

Mr. Gary Leinweber Amendment of Liquid Waste Discharge Permit ID #901 DRAFT Page 2

An application for amendment of NEC's current Liquid Waste Discharge Permit ID #901 to allow for additional discharge from the planned groundwater treatment system is enclosed. The application consists of the appropriate revised forms and supporting drawings.

If you have any questions or require further design information, please do not hesitate to call Janet Argyres of Bechtel at (415) 768-9917 or me at (415) 965-6096.

Very truly yours,

DRAFT

Michael A. Kierig NEC Electronics Inc.



LIQUID WASTE DISCHARGE PERMIT

1000 VILLA STREET, MOUNTAIN VIEW, CA 94041 • 415-903-6378

THE FIRM CORPORATION NAMED HEREIN IS AUTHORIZED TO DISCHARGE REGULATED WASTEWATER INTO THE SANITARY SEWER IN ACCORDANCE WITH CHAPTER 35 OF THE MOUNTAIN VIEW CITY CODE.

Permitted NEC Electronics, Inc. Facility 501 Ellis Street

NEC Electronics, Inc.

P.O. Box 7241

Mountain View CA 94039

Attn: Michael Kierig

EPA Category/Subcategory: Non-EPA

References

Local Category: Groundwater

Date Issued: 3/28/94

Date Revised:

Date Expires: 5/1/97

Permit ID: 901

Phil Bobel, Marager

Palo Alto Environmental Compliance Division

Cary Leinwebez, Manage

Mountain View Environmental Safety Division



POST IN A CONSPICUOUS PLACE AT THE "PERMITTED FACILITY" SITE



I. Discharge Limitations:

Process Discharge (Industrial Waste) shall not exceed 1,000 GPD Total Discharge (Industrial & Domestic Waste) shall not exceed 1,000 GPD

II. Special Conditions/Requirements:

Due Date:

1. Sampling arralysis shall employ EPA 601/602 method.

-	Sample	ing Analysis: Sample		Avg.Limit	Loc.Inst.	Sampled
Pollutant Total Toxic Organics	Per Dis Event	Location(s)*	(mg/L)	(mg/L) No Limit	(mg/L)	By NEC
ingle Toxic Organic	1	Al	1	No Limit	: :	NEC
			1			
	١.]		ļ	
•	'		•			
ì	,					

^{*}Sampling Location A1 is at the discharge end of the holding tank.

IV. Wastewater Discharge Limits: (MVCC 35.32.14 & CFR 40)

If your average wastewater discharge flow into the sanitary sewer system is AT OR BELOW 50,000 gallons per day (GPD), your wastewater effluent shall not exceed the following limits:

TO

Discharge Parameter	Federal Inst.Max.	Federal Mon.Avg.	Local* Inst.Max.	Discharge Parameter	Federal Inst.Max.	Federal Mon.Avg.	Local* Inst.Max.
Arsenic	No Limit	No Limit	0.1 mg/L	Oil & Grease	No Limit	No Limit	200 mg/L
Cadmium	No Limit	No Limit	0.1 mg/L	Phenois	No Limit	No Limit	1.0 mg/L
Chromium Hex.	No Limit	No Limit	1.0 mg/L	рH	No Limit	No Limit	5.5-11
Chromium, Total	No Limit	No Limit	2.0 mg/L	Selenium	No Limit	No Limit	2.0 mg/L
Copper	No Limit	No Limit	2.0 mg/L	Silver, Photo	No Limit	No Limit	0.25 mg/L
Cyanide	No Limit	No Limit	1.0 mg/L	Silver, Non-Photo	No Limit	No Limit	0.50 mg/L
Fluoride	No Limit	No Limit	65 mg/L	Single Toxic Organic	No Limit	No Limit	0.75 mg/L
Formaldehyde	No Limit	No Limit	5.0 mg/L	Suspended Solids	No Limit	No Limit	6000 mg/L
Lead	No Limit	No Limit	0.5 mg/L	ToL Dissolved Solid	No Limit	No Limit	10000 mg/L
Mercury	No Limit	No Limit	0.05 mg/L	Total Toxic Organic	No Limit	No Limit	1.0 mg/L
Nickel	No Limit	No Limit	1.0 mg/L	Zinc	No Limit	No Limit	2.0 mg/L

^{*}Local instantaneous maximum limits refer to 24-hour composite samples except for Cyanide, Single Toxic Organic, and Total Toxic Organics which are grab samples. If your average wastewater discharge flow EXCEEDS 50,000 GPD, your wastewater effluent shall not exceed ONE-HALF (1/2) of the local limits listed above, except for silver, oil & grease, suspended solids, total dissolved solids, fluoride, and pH.

- V. Sample Collection and Analysis: (MVCC 35.32.17.3, 40 CFR 403.12A(G), 40 CFR 136)
 All metals shall be collected as 24-hour composite samples except for Cyanide and Total Toxic Organics (TTO) which shall be collected as grab samples. Samples shall be analyzed by an analytical laboratory approved by the State of Cal.

 Dept. of Health Services. Sample collection, preservation, and analysis shall be in accordance with EPA regulations (40 CFR 136) and the City of Mountain View's "Sample Collection, Analysis and Reporting Instructions".
- VI. Quality Assurance/Quality Control: (MVCC 35.32.17.3, 40 CFR 403.12A(G), 40 CFR 136)
 All metals samples must be collected in duplicate and stored and preserved until the next sampling event for that parameter. The duplicate sample must be labeled as a duplicate and made available to any City inspector.

VII. Violation Reporting & Follow-Up: (MVCC 35.32.8.2)

If the results of any sampling or pH analysis exceed the applicable limit(s), you shall:

- 1) VERBALLY NOTIFY THE CITY OF MOUNTAIN VIEW AT 415-903-6378 WITHIN 24 HOURS of knowledge of the violation. If an accidental discharge, slug discharge, or upset or failure of the pretreatment system occurs, verbal notification shall be made within 15 minutes of knowledge of the condition;
- 2) SUBMIT A WRITTEN REPORT WITHIN 15 WORKING DAYS of knowledge of the violation explaining: the nature, volume, and duration of the violation, and mitigation measures taken to correct it and prevent reoccurrence;
 - 3) INITIATE A SAMPLING/ANALYSIS PROGRAM demonstrating up to 21 consecutive days of compliance.

VIII. Penalty Provisions: (MVCC 35.32.21)

Any person who violates any provision of this permit or Chapter 35 MVCC shall be civilly liable in a sum not to exceed \$6,000/day for each day in which such violation occurs. In addition, violation of compliance directives in any "Notice of Violation" is subject to administrative penalties not to exceed \$6,000/day.

IX. Transferability of Permit: (MVCC 35.32.2.3)

This permit is not transferable without prior written notification to and approval by the City and the assumption of all permit conditions and requirements by the new owner/operator.

A copy of the Industrial Wastewater Ordinance (Chapter 35, MVCC) and "Sample Collection, Analysis and Reporting Instructions" document are available on request from any Industrial Wastewater Specialist at 415-903-6378.



1000 VILLA STREET, MOUNTAIN VIEW, CA 94041 • 415-903-6378

HM3-1 (Rev. 9/93)

ENVIRONMENTAL COMPLIANCE PLAN FACILITY DIRECTORY

(see back of sheet for instructions)

(over)→

Business Name			Busin	ness Phone Number
(1) NEC Electronics	In.		(2) (415) 960-6000
Facility Street Addre				
(3) Sol Ellis St.				
Mailing Address		City	State	Zip Code
(4) 475 Ellis St.		Mountain V	ew CA	94039
Attention				
(5) Michael Kierig				
	Name	 	Phone	Number
(6) Property Owner	Renault & Handley Co	>	(415) 321	-3040
(7) Persons Responsible Fo	or Responding In An Emergen	cy After Normal Work H	lours	
Name Name	Title -	Home Phone No		Work Phone Number
Cheryl Goodwin		(415) 325-84	152	(415) 321-3040
Home Address:				
Name	Title	Home Phone N	umber	Work Phone Number
		()		()
Home Address:				
•	m: 41	77 79 37	<u> </u>	*** 1 ***
Name	Title	Home Phone No	umber	Work Phone Number
		,		
Name	Title	Home Phone No	umber	Work Phone Number
(8) Business Activity Des	cription	(9) SIC Code	(10) Dun & Bradstreet No.
<u> </u>		<u> </u>		
(11) Other Environmental	Permits. Permitting Agency:	Perr	nit Type:	I.D. #
(12) Shift Times:				
First: to	Second:	to	Third	to
(13) Approximate Number First:	r of Employees on Site Per Shi Second:	ft: Third:		
penalty of law that th inquiry of those indiv submitted information	east the level of Vice-Presiden is information was obtained in riduals responsible for obtaining is true, accurate and comples mation, including the possibility.	n accordance with appliing the information repo ete. I am aware that the	icable requiren orted herein, I re are significa	nents. Based on my believe that the
Print Name	Signature		Title	Date

Yellow: Fire Department

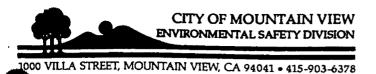
White: Applicant

CITY OF MOUNTAIN VIEW **ENVIRONMENTAL SAFETY DIVISION**

ENVIRONMENTAL COMPLIANCE PLAN WASTEWATER DISCHARGE SUMMARY

(see back of sheet for instructions)

OO VILL	A STREET, MOUNTAIN VIEW, CA 9404	1 • 415-	903-6378		(see back of sheet for instructions)
	Business Name				Page of Pages
(3)	NEC Electronics Inc.				(1)
	Facility Street Number	St	reet Name		Date
	501 Ellis St.				(2) June 3, 1996
(4) (5)	Wastewater Generating Activity Process Flow Diagram	y: 0	urging & Sampling Groundwate Treatment System Diagram	2 (Discharge Data
	NEC 1A, 3A, 381, 4A, 7A, 8A, 8B1,		Dathara		(8) Discharged to: Santary Sewier
	882, 883, 9A, 9BI, IOA, IOBI,	→		→	(9) Location: Behind Sol Ellis Bldg.
	11A, 11A, 1281, 13A, 13G1, 14A, 1481, 15A, 15B1, 16A, 14G1,		(no treatment)		(10) Frequency: Periodic Continuous
	17A, 1761, 18A, 18B1, 18B2, 19A		Frequency: Batch Continuous		(11) Avg. Daily Flow: 7 GPD
	, 20A, 20B1, 21A, 21B1, 22A, 23A				(12) Max. Daily Flow: GPD (13) Flows are: Estimated Measured
14	A, 25A, 26A				(15) Hows are. Estimated Measured
(4)	Wastewater Generating Activity		Extraction of Groundwater		Dischause Date
(5)	Process Flow Diagram	(6) 	Treatment System Diagram		Discharge Data (8) Discharged to: Sonton Some
	NECIAE, NEC 22AE,	→	Holding tank → 3 GAC Units in series	-	(9) Location: Rebind Soi Ellis Bidg
	NEC 27AE		Units in series		(10) Frequency: Periodic Continuous
	3.00	(7)	Frequency: Batch Continuous		(11) Avg. Daily Flow: 3,000 GPD
					(12) Max. Daily Flow 14400 GPD
					(13) Flows are: Estimated Measured
(4)	Wastewater Generating Activity				
(5)	Process Flow Diagram	(6)	Treatment System Diagram		. Discharge Data
					(8) Discharged to:
				_	(9) Location:
					(10) Trequency. Terrodicy Committations
		ı (7)	Frequency: Batch/Continuous		(11) Avg. Daily Flow: GPD
		,	1		(12) Max. Daily Flow: GPD
					(13) Flows are: Estimated/Measured
(4)	Wastewater Generating Activit	3.7			
(5)	Process Flow Diagram		Treatment System Diagram		Discharge Data
		1			(8) Discharged to:
		→		+	(9) Location:
					(10) Frequency: Periodic/Continuous
		J (7)	Frequency: Batch/Continuous		(11) Avg. Daily Flow: GPD
		V 7	. ,		(12) Max. Daily Flow: GPD
					(13) Flows are: Estimated/Measured



ENVIRONMENTAL COMPLIANCE PLAN FACILITY MAP

(see back of sheet for instructions)

Business Name		Date
NEC Electronics I	nc.	June 3, 1996
Facility Street Number	Street Name	
SOI Elis St.		

Provide a line drawing of your facility below following the example and instructions on the back of this form.

Attached Figures -

Figure 1. Location Map of NEC Monitoring Wells

Figure 2. SCGWR System Plot Plan (Drawing C-001)

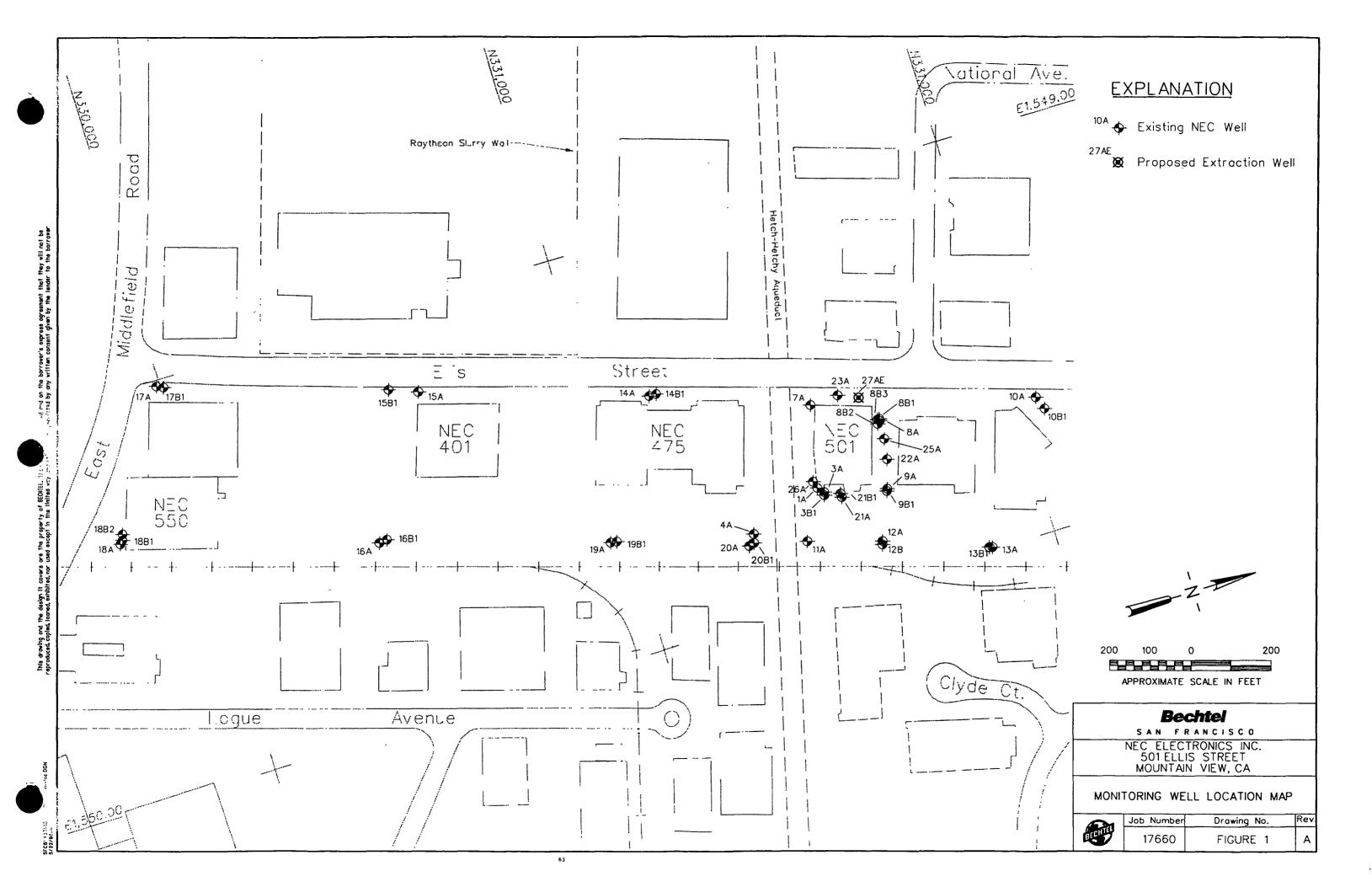
Figure 3. Piping & Instrumentation Diagram (Drawing M-001)

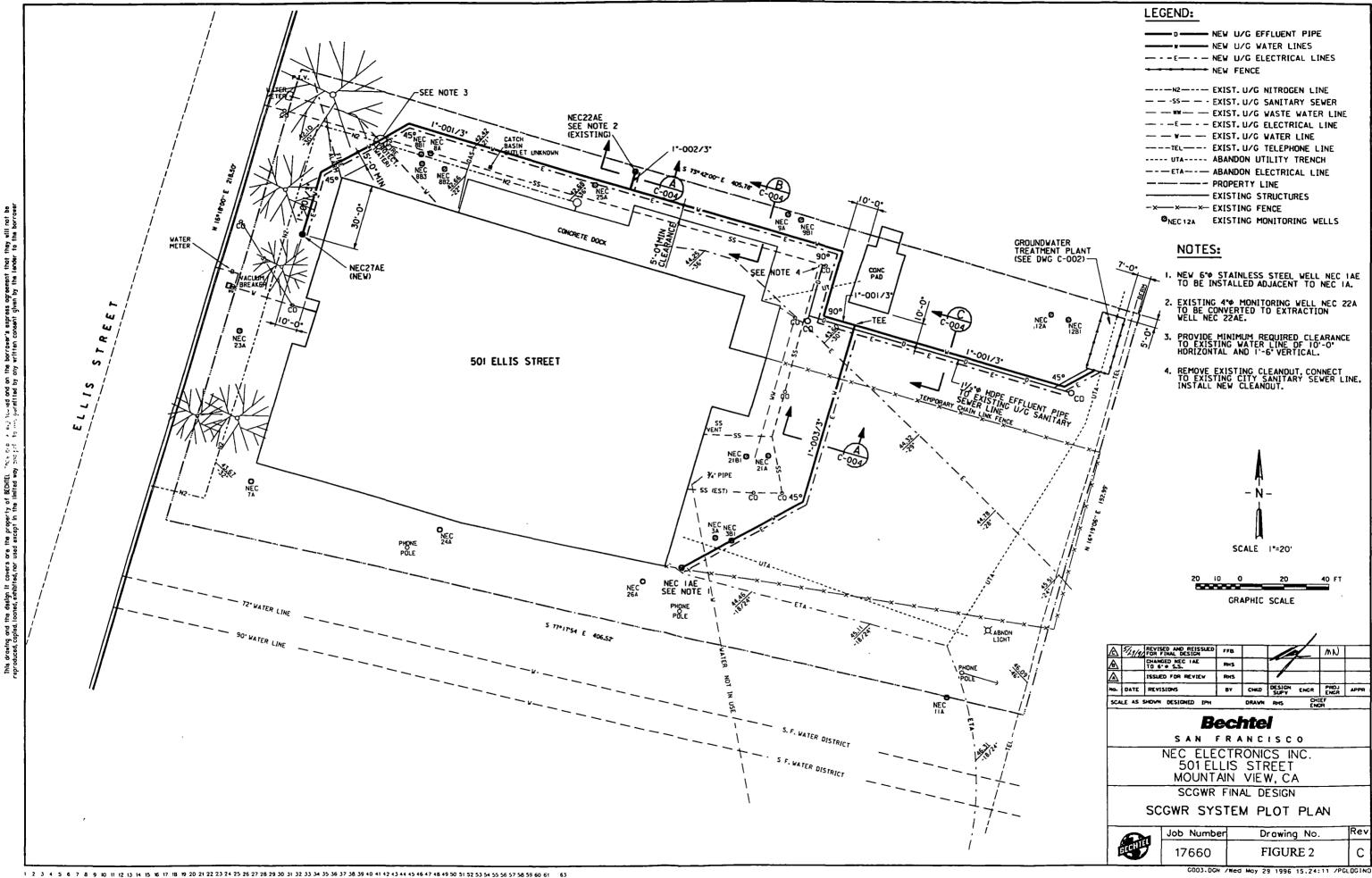
HM3-2 (Rev. 9/93)

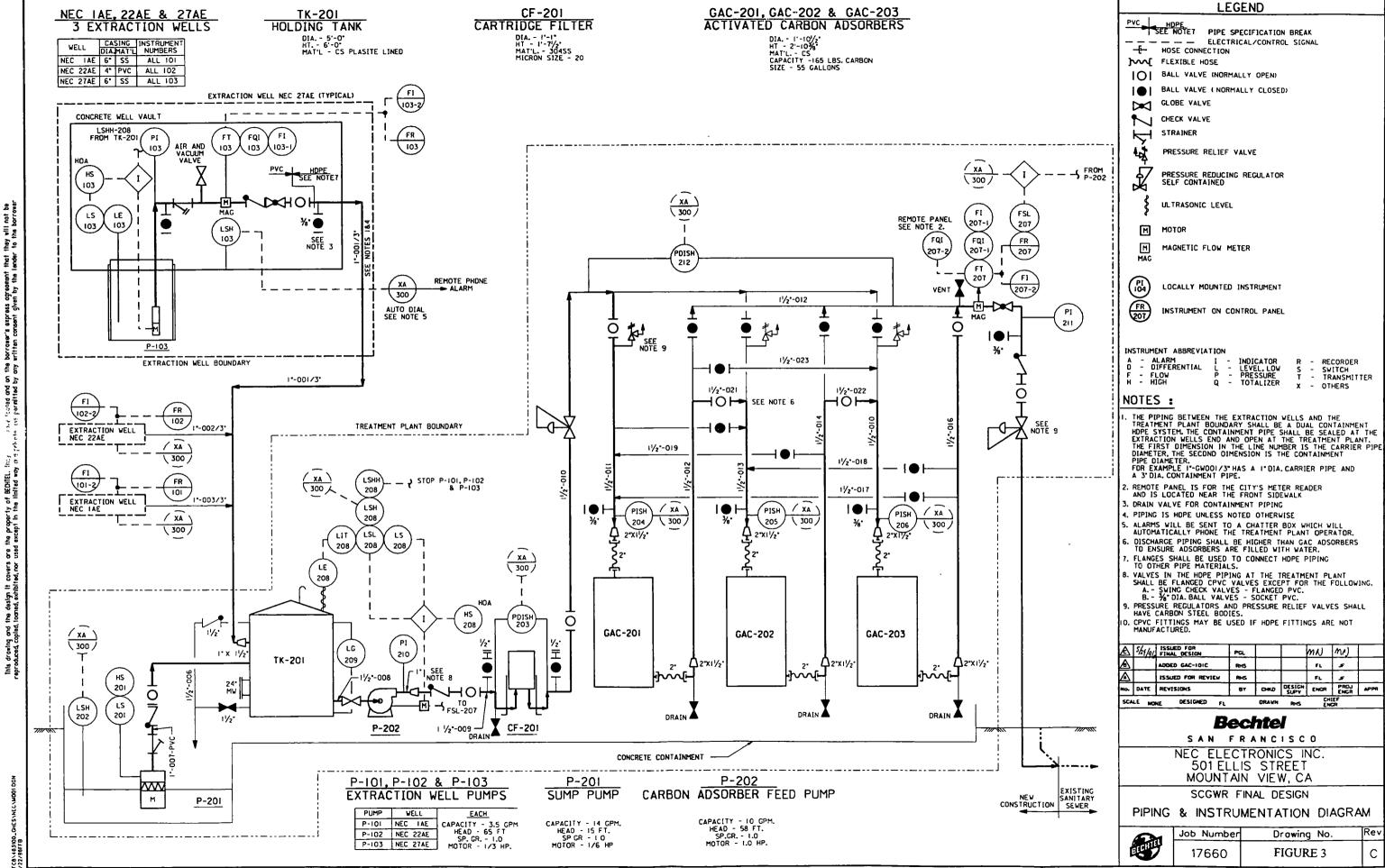
White: Applicant

Yellow: Fire Department

(over) →







1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 15 17 18 19 20 21 22 23 24 25 26 27 78 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63



BO PERMIT FORM (REV 5/94)

CITY OF MOUNTAIN VIEW

Community Development Department • Building Inspection Division 500 Castro Street • Post Office Box 7540 • Mountain View, California 94039-7540 • (415) 903-6313 • FAX (415) 903-6474

Address of Work/Site 501 Ellis Street				Unit/Apt.	PC	No. (Office Use)		
API	LICANT			<u>OWNEI</u>	R OF PROPI	ERTY		
Name/Company				Name				
NEC Electronic	s Inc.			Renault and t	landley co	•		
Address				Address				
475 Ellis Street	, †			400 Hamilton	Ave.			
City	State	Zip		City	State	e Zip		
Mountain View	CA	94039		Palo Alto	CA	94301		
Contact (Name)	······································			Contact (Name)				
Michael Kierig) -			,				
Area Code Ph	one			Area Code Phone (415) 321-3040				
(415) 965-60	96							
t	<u> </u>							
	TRACTOR				TECT/DESIG	GNER		
Name/Company		ate Contr Lice	nse	Name/Company				
To be determine	169			Bechtel Environ	omontal			
Address				Address				
				50 Boale St.				
City	State	Zip		City	Stat	e Zıp		
				Son Francisco	(A	94105		
Contact (Name)				Contact (Name)				
				Janet Angres	3			
Area Code Ph	one			Area Code	Phone			
				(415) 768-99	7			
			J	<u> </u>				
	, ,		quare Ft	Construction C				
(Office Ose) (Office	le Ose) (Onic	.e Ose) 1mg	provement	Labor & Mate	riai			
				<u> </u>				
DESCRIBE TYPE	OF CONSTRU	ICTION:	(onstr	uction of a 301	o Savara A	ont-		
_	_							
groundwater	<u>treatment</u>	- tiao	1800					

Official Use Only Acct No. 213215-2707 C.E.O.A. D. Noo-Exempt D. Exempt Class
☐ Site Plan & Architectural Approval Application No. Zone
☐ Conditional Use Permit ☐ Variance ☐ Planned Community Permit ☐ Conditional Use Permit ☐ Conditional Use Permit ☐ Date Stamp Scheduled For
□ Planned Unit Development □ Other Fee
Receipt No.
PROPOSAL
Materials Distribution: FD HM PD PW BD PK Other
COMPLETE THIS SECTION FOR ALL APPLICATIONS
Name of Legal Property Owner Renault and Handley Co Telephone (415) 321-3040
Owner's Address 400 Hamilton Ave. City Palo Alto Zip Code 94301
Agent's Name (Applicant filing for owner) NEC Electronics Inc. Telephone (415) 965-6096 Agent's Address 475 EUIS Street City Mountain Vicu Zip Code 94039
Property Address 501 Ellis Street APN No.
Briefly Describe Proposal Construction of a 300 square foot groon durder treatment unit
COMPLETE APPLICABLE SECTIONS FOR SPECIAL ZONING ACTION
□ CONDITIONAL USE PERMIT OR PLANNED COMMUNITY PERMIT
State why use is appropriate in this location for proper community development
State why use will not be detrimental to proper community development and abouting account.
State why use will not be detrimental to proper community development and abutting property

□ VARIANCE	
State the extraordinary circumstances that apply to this property, but	
uses in the zone	
State why Variance is necessary for the preservation of substantial	property rights
	,
State why granting the request will not be detrimental to persons in	the area or to abutting property or the neighborhood
Otato why granking the request will not be detrimental to persons in	and area of to abouting property of the neighborhood
-	-
☐ PLANNED UNIT DEVELOPMENT OR PLANNED RESI	DENTIAL DEVELOPMENT
Describe how proposed development conforms to the General Plan	and is in substantial compliance with the regulations of this
zone	
Describe how proposed development is in substantial compliance v	with development and intensity regulation of this zone
- Describe from proposed development is in substantial compliance.	Thir development and intensity regulation of this 20116
I declare under penalty of perjury that I am the owner or ing statements and answers herein and all data and info are to the best of my knowledge and belief true and cor	ormation, documents and evidence herewith submitted
Signature of Courses at A	D .
Signature of Owner or Agent	Date



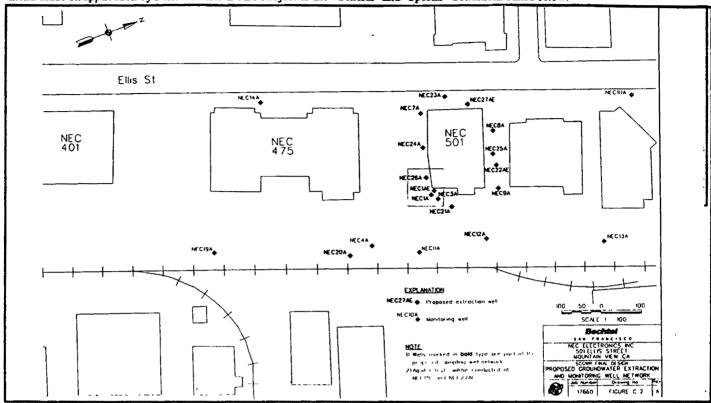
WELL CONSTRUCTION APPLICATION

5/5U Almaden Expressway, San Jose, CA 95118 (408) 255-2500 FC 136 (04-22-92) (0P4-901)					
District Permit No.:	TO BE COMPLE Date Issued:	ETED BY DISTRICT	Wall Registration No:		
Geologic Setting:	Expiration Date:		Driller's Log Na:		
	TO BE COUD! ETED P	Y OWNER AND DRILL	P n		
Property Owner:	Well Owner (if different		Drilling Co.		
	NEC Electron		78D		
Renault + Handley Co. Address:	Address of Well Site:	:	Driller's Contractors License Number (C-57 Req'd):		
400 Hamilton Ave.	501 Ellis St.	,			
City, State, Zip	City, State, Zip:		Address:		
Palo Alto CA 94301	· /	w CA 94309			
Telephone No:	Telephone No:		City, State, Zip:		
,	(415) 965-6				
Assessor's Parcel No. of Well site: Book 159 Page 44 Parcel 04	Owner's/Consult		Telephone No		
	Less than 50 ft.	50 to 300 ft.	Over 300 ft		
Purpose of Well. Domestic		Agricultural	Monitoring Cathodic Protection		
*Monitoring wells are those constructed for the analysis. This includes wells constructed for ge conformance with the Hazardous Materials Storage tanks.	purpose of obtaining rep eneral exploration and in prage Permit Ordinance for	petitive water level meas nvestigation purposes as for site-specific groundw	surements and/or repetitive air samples for s well as those to be constructed in vater monitoring of existing underground		
			R EXTRACTION/RECOVERY WELLS		
		rdous Materials Storage			
Other (specif	у)		Extraction/Recovery		
NAME OF BUSINESS AT WELL SITE:					
If proposed well is to meet compliance with a H	lazardous Materials Sto	rage Permit Ordinance h	has the City or County been contacted? Yes No		
			vice. 🔀 Groundwater 🔲 Vadose		
	1	1	vice.		
Consultant's Name (Company)		Monitoring well use			
Rechtel Environmental In		1	Depth Quality Chloride		
Address:	<u> </u>	VACOSE GEVICE HISTORIC	ation. Vapor Interface Suction Lysimeter		
	!				
50 Beale St.		Signa	ature of Responsible Professional		
City, State, Zip:	_	(מט טמן	stitution of signature will be accepted)		
San Francisco CA 94105	<u>></u>		- To the Proposition		
Telephone No. (415) 768-1234	1	Registration No. Civil Engineer	OR Certificate No. Engineering Geologist		
		Litymes.			
TOPOGRAPHIC FEATURES Well is to be constructed: In a public side	The equilieron	4 Co cubic gragery	y 🔀 On private property 🔲 On SCVWD property		
Within 50 ft of the top of a creek bank		No Within 50 ft of an			
Within 50 ft of a sanitary sewer	☑ Yes ☐ N	No Within 150 ft of a	a cesspool or seepage pit 🔲 Yes 🔀 No		
Within 100 ft of a pit privy, septic tank, leachfie	eld 🗌 Yes 🔯 N		· · <u>-</u>		
CERTIFICATION BY WELL OWNER/AGENT	AND DRILLER/AGEN	I: Status 💢	Active Inactive Abandoned		
I certify that the information given above is co	orrect to the best of my ki	cnowledge I certify that	the well will be constructed in compliance with the		
conditions of this permit, the Santa Clara Valle Ordinance of the County or City, as appropria	ley Water District's Ordinate. It is my responsibilit	nance 90-1 and, if applica	cable, the Hazardous Materials Storage Permit notify this District of any changes in the purpose of		
this well from that which is indicated on this a	application form		MONITORING WELL PLAN APPROVAL		
**************************************			City/County:		
Signature of Well Owner/Agen	it	Date L	Approved by:		
		ľ	Date:		
Signature of Druller/Agent		Date			

DISTRICT WELL PERMIT NO.:

WELL CONSTRUCTION APPLICATION

Based on information on the application and attachment(s) hereto (if any) and subject to approval noted below, permission is hereby granted to construct (drill) the described well. Permission to start may be withheld until a field check verifies all statements made on application by Permittee and is also subject to the "General" and "Special" Conditions stated below.



GENERAL CONDITIONS

- S.C.V.W.D. Well Inspection Department (Telephone 408-927-0710, ext. 660) must be notified a minimum of one working day prior to starting work.
 Construction under this Permit is subject to any instructions by District representative relative to the "Standards for the Construction of Wells in Santa Clara County". A District Inspector must be on site to witness all annular sanitary seals.
- B. Permit may be voided before work begins if field check reveals any misrepresentation under "well location" or "Topographic Features" on application.
- C. This Permit is valid only for the purpose specified herein. No change in construction procedure as prescribed in District Standards and in Special Conditions below will be allowed except upon written permission of the District.
- D. Permittee shall assume entire responsibility for all activities and uses under this Permit and shall indemnify, defend and save the District, its officers, agents and employees free and harmless from any and all expense, cost or liability in connection with or resulting from the exercise of this Permit including, but not limited to, property damage, personal injury and wrongful death.
- E. Compliance with "CAL/OSHA", California Labor Code Section 6300 (and following) is required.
- F. Water quality and production from all wells to be used for public water supply must be approved by the County Environmental Health Services.
- G. Permit will be automatically canceled if not exercised or if extension is not requested by Permittee within 180 calendar days.
- H. Driller is to complete State DWR Form 188 and mail original to Santa Clara Valley Water District within 30 days of completion of well construction.
- I. For the construction of all types of wells, a Permittee must be a licensed C-57 water well drilling contractor.
- J. Dry holes shall be backfilled within one week of drilling. Backfilling shall be done in accordance with District Standards.
- K. Each well requires a separate Well Construction Application and Permit.
- L. Permittee shall seal all abandoned wells on the property.
- M. All drilling fluid and materials will be safely handled and properly disposed of in the appropriate method.
- N. Permittee shall have a current copy of their Workman's Compensation Insurance on file with the S.C.V.W.D.

SPECIAL CONDITIONS:	
SCVWD APPROVED:	DATE.



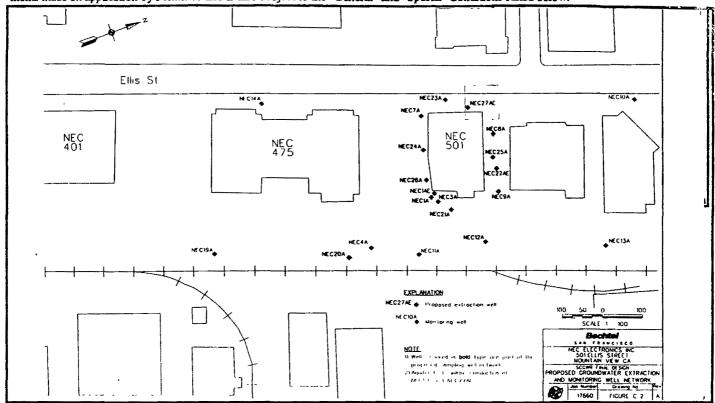
WELL CONSTRUCTION APPLICATION FC 158 (04-22-92) (DP 4-901)

5750 Almaden Expressway, San Jose, CA 95118 (408) 265-2600 FC 158 (04-22-92) (0P 4-901) TO BE COMPLETED BY DISTRICT						
District Permit No.:	TO BE COMPLI	ETED BY DISTRICT	Well Registration No:			
· ·			Application res			
Geologic Setting:	Expiration Date:	***************************************	Driller's Log No:			
	TO BE COMPLETED B	Y OWNED AND DOUG	ro			
Property Owner:	Well Owner (if differen		Drilling Co.			
Renault + Handley Co.	NEC Electronics	•	T80			
Address:	Address of Well Site:		Driller's Contractors License Number (C-57 Reg'd):			
400 Hamilton Ave	SOI Ellis St.					
City, State, Zip:	City, State, Zip:		Address			
Pala Alto CA 94301	Mountain Ville	CA 94309				
Telephone No:	Telephone No.		City, State, Zip:			
	(415) 965-6	096				
Assessor's Parcel No. of Well site:	Owner's/Consul		Telephone No:			
Book 159 Page 44 Parcel 04	NEC NEC	17AE				
Estimated depth of completed well:	Less than 50 ft.	50 to 300 ft.	Over 300 ft			
Purpose of Well: Domestic	Municipal/Industrial	Agricultural	Monitoring Cathodic Protection			
*Monitoring wells are those constructed for the						
analysis This includes wells constructed for go conformance with the Hazardous Materials Sto						
hazardous materials storage tanks	rage Permit Ordinance	or site-specific grounds	rater monitoring or existing underground			
THIS SECTION TO BE COMPL	ETED FOR ALL MON	NITORING WELLS O	R EXTRACTION/RECOVERY WELLS			
Purpose of Monitoring Well To comply wi						
Other (specia	y) [.]	_	Extraction/Recovery			
NAME OF BUSINESS AT WELL SITE:						
It proposed well is to meet compliance with a H	lazardous Materials Sto	rage Permit Ordinance	has the City or County been contacted? Yes No			
		Type of extraction dev				
Consultant's Name (Company)		Monitoring well use	Depth Quality Chloride			
BECHTEL Environmental, Inc	L _	1	ation. Vapor Interface Suction Lysimeter			
Address:		744030 007100 m3.tam	vapor mieriace Succion Lysimeter			
so begie st						
City, State, Zip:	······································		ature of Responsible Professional stitution of signature will be accepted)			
San Francisco CA 94105	•	• • • • • • • • • • • • • • • • • • • •				
Telephone No.:		Registration No. Civil	OR Certificate No Engineering			
(415) 769-1234		Engineer	Geologist			
TOPOGRAPHIC FEATURES						
Well is to be constructed: In a public side	walk 🔲 In a public roa	d 🔲 On public propert	On private property On SCVWD property			
Within 50 ft of the top of a creek bank	☐ Yes 🛛 I	No Within 50 ft of a	ny existing well Yes 🔀 No			
Within 50 ft of a sanitary sewer	⊠ Yes □ I	No Within 150 ft of a	a cesspool or seepage pit Yes 🔀 No			
Within 100 ft. of a pit privy, septic tank, leachfie	old 🗌 Yes 🔯 I		ton this property Yes \(\) No			
CERTIFICATION BY WELL OWNER/AGENT	AND DRILLER/AGEN	Status 🔀	Active			
			the well will be constructed in compliance with the			
			cable, the Hazardous Materials Storage Permit notify this District of any changes in the purpose of			
this well from that which is indicated on this a		, as the we ll Owner to f				
1	•		MONITORING WELL PLAN APPROVAL			
Signature of Well Owner/Ager	nt	Date	City/County:			
3			Approved by:			
Signature of Driller/Agent		Date	Date:			

IMPORTANT: A minimum 24-hour notice must be given to SCVWD Well Inspection Dept. prior to installing the annular seal.

DISTRICT WELL PERMIT NO.: WELL CONSTRUCTION APPLICATION

Based on information on the application and attachment(s) hereto (if any) and subject to approval noted below, permission is hereby granted to construct (drill) the described well. Permission to start may be withheld until a field check verifies all statements made on application by Permittee and is also subject to the "General" and "Special" Conditions stated below.



GENERAL CONDITIONS

- A. S.C.V.W.D. Well Inspection Department (Telephone 408-927-0710, ext. 660) must be notified a minimum of one working day prior to starting work.
 Construction under this Permit is subject to any instructions by District representative relative to the "Standards for the Construction of Wells in Santa Clara County". A District Inspector must be on site to witness all annular sanitary seals.
- B. Permit may be voided before work begins if field check reveals any misrepresentation under "well location" or "Topographic Features" on application.
- C. This Permit is valid only for the purpose specified herein. No change in construction procedure as prescribed in District Standards and in Special Conditions below will be allowed except upon written permission of the District.
- D. Permittee shall assume entire responsibility for all activities and uses under this Permit and shall indemnify, defend and save the District, its officers, agents and employees free and harmless from any and all expense, cost or liability in connection with or resulting from the exercise of this Permit including, but not limited to, property damage, personal injury and wrongful death.
- E. Compliance with "CAL/OSHA", California Labor Code Section 6300 (and following) is required.
- F. Water quality and production from all wells to be used for public water supply must be approved by the County Environmental Health Services.
- G. Permit will be automatically canceled if not exercised or if extension is not requested by Permittee within 180 calendar days.
- H. Driller is to complete State DWR Form 188 and mail original to Santa Clara Valley Water District within 30 days of completion of well construction.
- I. For the construction of all types of wells, a Permittee must be a licensed C-57 water well drilling contractor.
- J. Dry holes shall be backfilled within one week of drilling. Backfilling shall be done in accordance with District Standards.
- K. Each well requires a separate Well Construction Application and Permit.
- Permittee shall seal all abandoned wells on the property.
- M. All drilling fluid and materials will be safely handled and properly disposed of in the appropriate method.
- N. Permittee shall have a current copy of their Workman's Compensation Insurance on file with the S.C.V.W.D.

SPECIAL CONDITIONS:	
SCVWD APPROVED	DATE:

Adjacent Property Access

Section IX.D.2.b(3)(c) of the §106 Order requires specifications for provisions for gaining access to and obtaining samples from adjacent properties. For the proposed Source Control Groundwater Remediation (SCGWR) system, these provisions are mainly applicable for access to monitoring wells, as part of the Site Environmental Monitoring Plan, which are located offsite. Background well, NEC20A, is the only offsite monitoring point requiring this access, as all other wells are located within the boundaries of the 501 Ellis Street property. Currently, there exists an agreement from the property owner of the 501 Ellis Street site [Renault and Handley Employees Investment Co. (Renault and Handley)] to access and sample groundwater from the on-site wells (Attachment H-1). NEC20A is located in the adjacent property to the south which is currently occupied by NEC Electronics Inc. (NEC) and is also owned by Renault and Handley. Access to this well is secured during NEC's occupancy, and a similar access agreement from Renault and Handley following NEC's vacancy is anticipated.



RENAULT & HANDLEY

Industrial & Commercial Ruel Estate

NEC ELECTRONICS

MAY 1 8 1992

RISK MANAGEMENT

May 14, 1992

Mr. Michael A. Kierig Risk Manager NEC Electronics, Inc. 401 Ellis Street P.O. Box 7241 Mountain View, CA 94039

RE: Access to Monitoring Wells at 501 Ellis Street for routine groundwater monitoring.

Dear Mr. Kierig:

Permission is hereby granted to access and sample groundwater from the wells as referenced above. To the best of my knowledge, the water supply is on at the facility and will remain on because of the necessity to keep the front landscaping watered.

The above permission is effective immediately and shall be effective until such time as you may be notified to the contrary.

Very truly yours,

RENAULT & HANDLEY EMPLOYEES INVESTMENT CO.

Lester A. Waller, President

LAW:mac

Responses to EPA Comments

Appendix I documents the EPA's comments on the draft Final Design Report and NEC's responses to the EPA comments. The EPA's comments were transmitted in a letter dated July 17, 1996. The EPA's had two (2) general comments and fifteen (15) specific comments. The EPA's comments are shown in italics below and NEC's responses to comments are shown in normal text. NEC's responses include a separate table, Table I-1, which shows the location of where specific changes in the report will be made. The page locations shown in Appendix I are referenced to the draft report and minor variations between the page numbering in the final and draft report are expected. In addition to the EPA comments NEC has proposed two design developments that would facilitate construction of the treatment plant.

The EPA's comments and NEC responses are as follows:

GENERAL COMMENTS

Number 1: Based on the aquifer test conducted in March 1996 on wells NEC12A and NEC1A, it seems that the extraction wells may not be able to provide long term extraction sufficient to adequately capture the VOC plume. Therefore, it should be understood by NEC, and stated in the text, that field verification of hydraulic control will be used to determine if there are enough extraction wells and whether adequate remediation is occurring. If the capture zones or pumping abilities for these three initial wells are not sufficient, then NEC will need to install additional wells or consider other alternatives to remediate the plume.

Response: The text has been modified to note that NEC will include field verification of hydraulic control as an Operation and Maintenance Plan (O&MP) activity. In the event that hydraulic control is not achieved by the three wells NEC will expeditiously evaluate alternatives, including the need to install additional wells.

Number 2: Table 5-2 indicates the maximum contaminant levels (MCLs) for the MEW chemicals of concern, some state and some federal. It should be noted in Section 5.1 and on Table 5-2 that the Record of Decision determined that federal MCLs would be used as the cleanup standards.

Response: Section 5.1 and Table 5-2 has been revised to note that the ROD determined that federal MCLs would be used as the cleanup standards. Table 5-2 has been revised to separately list the federal and state standards from the ROD.

SPECIFIC COMMENTS

Number 1: Page 2-5, section 2.2.3. The text states that constituents in the A, B and C aquifer limit the uses for groundwater without prior treatment, however it should also be noted in the text that all groundwater on site meets the state's definition of a potential drinking water source. The text incorrectly refers to micrograms per liter as mg/l. Please correct this discrepancy.

Response:

A new sentence has been added to the text noting that the on-site groundwater meets the state's definition of a potential drinking water source. The incorrect abbreviation (mg/L) for micrograms per liters has been changed to the correct abbreviation (µg/L).

Number 2:

Page 2-6, section 2.2.3. It should be noted that although trichloroethene (TCE) is being utilized as an indicator compound for evaluating cleanup, all chemicals of concern must reach their respective cleanup standards regardless of the levels of TCE, as stated in the Explanation of Significant Difference, dated September 1990.

Response:

Section 2.2.3 has been modified to include a statement that the cleanup standards for all chemicals of concern, regardless of the TCE level, will be used to monitor progress of the remedial effort as stated in the Explanation of Significant Difference.

Number 3:

Page 3-3, section 3.2. The text indicates that the chain link fence will have redwood slats. Redwood slats are not specified in Specification 02831. The text or specification should be revised to address this point.

Response:

Redwood slats are shown in the drawing C-003 that is referenced by specification 02831. However, to ensure that the slats will not be overlooked a new item, for slats, has been added to the specification.

Number 4:

Page 3-5, section 3.3.2. Valves used to regulate flow from the extraction wells should be specified in the equipment list.

Response:

The globe valves that will be used to regulate the flow from the extraction wells are specified in Section II (Unnumbered Extraction Well Equipment), item 7, page C-4 of the equipment list. The globe valves are 3/4 inch diameter Fisher-Porter valves.

Number 5:

Page 3-10, section 3.6.2. The Operations and Maintenance Plan for 501 Ellis must include the criteria which will be used to gauge when change-outs of the activated carbon adsorbers will be necessary.

Response:

The Operations and Maintenance Plan (O&MP) for 501 Ellis will include changeout criteria for activated carbon adsorbers.

Number 6:

Page 6-2, section 6.3. Monitoring well NEC20A is proposed in the text as a monitoring well selected for analytical groundwater monitoring. Figure 6-1 does not show monitoring well NEC20A as a proposed well for analytical sampling (not Italicized). Please correct this discrepancy.

The text states that after TCE concentrations stabilize, the analytical frequency will be reduced to every five years. The text should state that any reduction in frequency will be proposed to EPA and implemented after EPA approval.

Response:

Figure 6-1 has been revised to show monitoring well NEC20A as both bold and italicized to designate it as part of the water-level monitoring and groundwater quality network.

The text has been revised to state that after the annual TCE concentrations stabilize a reduction in frequency of sampling (for example, once in five years) could be implemented if the EPA approves.

Number 7:

Appendix C, page C-4, Equipment List. The description for Item 15 appears to be incomplete. The appropriate description should be added.

Response:

The description for item 15 was incomplete. The description did not include the following: "a level sensor. One 4- inch diameter and two 6-inch diameter seals." The missing portion of the description has been included in the final document.

Number 8:

Appendix D, Section 02200. If on-site soil is to be used as backfill all excavation specifications should be revised to include the current sampling protocols approved by EPA in other Source Control Remedial Design documents.

Response:

The majority of the soil to be excavated as part of the SCGWR, about 175 cubic yards, is expected to be used as backfill. Excavated soil materials will be collected in stockpiles and will be sampled and analyzed before reuse or disposal. One sample will be collected from every 25 cubic yards of stockpiled soils. Since soil at the site has been remediated, the samples of excavated soils to be analyzed for VOCs are expected to be below cleanup concentrations. Assuming this to be the case the excavated material will be acceptable as backfill.

If the sample results are above allowable on-site VOCs reuse concentrations the excavated material will be disposed of in an appropriate off-site facility. The sample results will be used to determine the appropriate off-site disposal facility.

The soil samples will be analyzed using the EPA Method 8010 analyte list, modified to include cis-1,2-dichlorothene (cis-1,2-DCE) and 1,1,2-trichloro-1,2,2trifluoroethane (Freon 113). See the response to comment number 10 for locations of the modified EPA Method 8010 analysis.

Item R has been added to the specification 02200 requiring the Contractor to stockpile excavated material prior to reuse or disposal. The Contractor will be advised that the Engineer will collect one sample from each 25 cubic yards of stockpiled material and that a laboratory analysis must be completed prior to the Contractor starting to backfill or dispose of excavated soils. The Contractor shall await the Engineer's direction before using stockpile soils as either backfill or for off-site disposal.

Number 9: Appendix E, page E1-5, Section E1.2.4. The Independent Quality Assurance Team (IQAT) should be identified in the Construction Operation and Maintenance Plan (COMP).

Response: Appendix E has been revised to state that specific IQAT personnel will be identified in the COMP.

Number 10: Page E2-5, Section E2.2.2. The text states that "[A]ll soil will be analyzed by a certified laboratory to ensure that it is below cleanup levels before it will be used to backfill or transported to a landfill." This section also refers to the Waste Management Plan, Appendix F. Page F3-1, section F3.2 of Appendix F, indicated that "[E]excavated soil materials will be managed and disposed as non-contaminated soil and/or contaminated soil... Excavated materials will be staged or stockpiled and used as backfill material." The next paragraph indicates "[E]xcess excavated materials will be sampled and disposed off-site."

- a) The text should clarify what is meant by "excess excavated materials" and how it differs from "excavated materials". It is unclear how many different categories of excavated soil material are being tracked and segregated (i.e., excavated, excess excavated, non-contaminated, and contaminated).
- b) For excavated soil materials, it is unclear how and when non-contaminated soil will be segregated from contaminated soil. Will the soil be field screened for chemicals during excavation/trenching operations to facilitate segregation into stockpiles, or will all the excavated soil be managed as soils suspected of containing chemicals and undergo confirmatory sampling? The text should clarify how it will be determined if a stockpile is "clean".
- c) The text should also clarify when soil samples will be collected to ensure that the soil is below cleanup standards.

The soil excavation portions of the text and the appropriate specifications in Appendix D should be revised to address these issues.

Response: Appendices E and F and specification 02200 (see specific comment number 8) have been modified to clarify the excavation issue. In Appendix E the following changes have been made:

 The title of section E2.2.2 has been changed from Backfill Material to Excavated Material. The more generic title includes excavated material from trenches, vaults, and the equipment pad. This section has been clarified to reflect that all soils will be stockpiled, sampled, and analyzed prior to reuse as backfill or off-site disposal.

- The draft SCGWR section E2.2.3 has been deleted. Trench excavation has been included as part of the excavated material in section E2.2.2.
- The draft SCGWR section E2.2.4 has been renumbered to section E2.2.3 in the final report.
- The title of section E2.3.3 has been changed from Trench Excavation Monitoring to Excavation Monitoring. This number of measurements has been revised from one for every 50 cubic yards to one for every 25 cubic yards.
- The index for section E has been revised to reflect the above changes.
- The title of section F3.2 has been changed from Excavated Trench Soils to Excavated Soil Materials. This section with subsections, F3.2.1 and F3.2.2, was rewritten to reflect that all soils will be stockpiled, sampled, and analyzed prior to reuse as backfill or off-site disposal.
- The title of section F4.1 has been changed from Sampling of Excavated Trench Soils to Sampling of Excavated Soils. Sections F4.1 and F4.2 have been revised to state that all soils will be stockpiled, sampled, and analyzed prior to reuse as backfill or off-site disposal.
- The index for section F has been revised to reflect the above changes.
 - a) The term excess excavated material was removed from Appendix E and was defined in Appendix F as soil materials that can not be reused as backfill and will be disposed of off-site.

There are the four categories of soil materials (excavated, excess excavated, non-contaminated, and contaminated) referenced in the SCGWR Final Design. Excavated soil material includes soil-material removed during excavation of trenches, vaults, and the equipment pad. It is not expected to be contaminated (above the cleanup level) but would be subject to testing. The excess excavated soil material is soil material that will not be reused on-site and will require off-site disposal. However, the sampling frequency will be the same.

Although an off-site disposal facility may require a lesser sampling frequency, one sample from from every 25 cubic yards stockpiled will be collected.

b) Although all of the excavated soil is expected to be non-contaminated, it will be stockpiled and tested before it will be reused or disposed off-site. The descriptions in sections E2.2.2 and F3.2 have been revised to clarify the procedure.

c) The revised descriptions in sections E2.2.2 and F3.2 clarify that a soil sample will be taken from a stockpile and analyzed prior to either reuse or off-site disposal. Soil sampling procedures will be included in the Construction Operation and Maintenance Plan (COMP).

Number 11: Page E2-6, Section E2.2.3 and page F3-1. The text states that one composite soil sample per 50 cubic yards will be collected from excavated material and analyzed for VOCs by EPA Method 8010. If soil is to be re-used and not disposed of offsite, the text and specifications must be consistent with the confirmatory sampling protocols (i.e., two discrete samples per 50 cubic yards) that were approved in the Source Control Remedial Design documents. In addition the text should be revised to indicate that soil samples will be analyzed by a state-certified laboratory using the EPA Method 8010 analyte list, modified to include cis-1,2-dichlorothene (cis-1,2-DCE) and 1,1,2-trichloro-1,2,2-trifluoroethane (Freon 113).

Response: The section E2.2.3 in the draft SCGWR has been deleted. The text in section E2.2.2 has been revised to state that one soil sample per 25 cubic yards (same as two soil samples per 50 cubic yards) will be collected from excavated soil stockpiles. The revised text states that soil samples will be analyzed using the EPA Method 8010 analyte list, modified to include cis-1,2-dichlorothene (cis-1,2-DCE) and 1,1,2-trichloro-1,2,2-trifluoroethane (Freon 113).

Number 12: Table E-2. The table should be revised to (1) specify the relevant standard (i.e., ASTM D1557), (2) reference the appropriate specification, ASTM method or standard operating procedure, and (3) indicate who will perform the test.

Response: Table E-2 has been revised to include columns to identify the relevant specification, specific referenced method or procedure (ASTM, ASME, etc.) and indicate who will perform the test. Sections E2.1.1 and E2.1.2 have been revised to be consistent with Table E-2.

Number 13: Page F3-2, Section F3.3. The text indicates that non-contaminated and contaminated drill cuttings will be disposed. However, Table F-1 indicates that non-contaminated drill cuttings may be used as backfill material or disposed in a municipal landfill. The text needs to include a discussion of how "clean" soils will be segregated from soils suspected of containing chemicals during drilling. Will the soil cuttings be field screened for chemicals during drilling operations to facilitate segregation into stockpiles, or will all the excavated soil be managed as soils suspected of containing chemicals and undergo confirmatory sampling? The FSCRD Report should be revised to address this discrepancy.

Response: Table F-1 is correct and the text should clearly state that drill cuttings will be either used as backfill material or disposed of in a municipal landfill. The text has been revised to state that the drill cuttings will be collected in drums. The stored

drums will be sampled, and tested before determining reuse or disposal. Additional text has been added to state the following:

- A sample from each borehole will be sent to an off-site state-certified laboratory for VOCs testing by EPA Method 8010.
- The EPA Method 8010 analyte list will be modified to include cis-1,2-DCE and Freon 113.
- The test results will determine whether the drill cuttings will be used as backfill or disposed of in a municipal landfill.

It was assumed that FSCRD in the comment was intended to be the Final SCGWR which will be revised as stated above.

Number 14: Page F3-3, Section F3.5. The last paragraph should be revised to indicate that non-hazardous waste <u>will be</u> disposed off-site and decontamination water <u>will be</u> contained, sampled, and discharged.

Response: The tenses of the verbs in the last paragraph have been changed from the past tense to future tense.

Number 15: Table F-1

- (a) The table should be revised to indicate that for soil used as backfill material, two discrete samples per 50 cubic yards of soil will be collected and EPA Method 8010 will be modified to include cis-1,2-DCE and Freon 113.
- (b) For clarification, each waste type should have its own line item for collection/storage, sampling and analysis, and disposal.

Response:

- (a) The table has been revised to indicate that for soil used as backfill material one discrete sample per 25 cubic yards of soil collected will be analyzed and that EPA Method 8010 will be modified to include cis-1,2-DCE and Freon 113.
- (b) Waste items 2a, 2b, 3a, 3b, have been revised to include separate collection/storage, sampling and analysis, and disposal descriptions.

DESIGN DEVELOPMENT

Number 1: Change the piping within the treatment plant limits from HDPE to CPVC.

Reason:

The piping within the treatment plant will require numerous valves and fittings that are primarily CPVC and PVC (not available in HDPE). Flange adapter will be required at each valve and fitting. Since there would be about 60 flange adapters required, each adapter is about six inches long, it would be difficult to accommodate them and maintain efficient use of space. Therefore, since both the HDPE and CPVC piping materials are suitable for the service, we propose to

charge the pipe material to CPVC. The use of HDPE is also not considered to be economical. By using CPVC material within the plant there will be savings of space and time that will reduce cost without sacrificing quality.

Number 2: Change the piping casing materials on the extraction wells from stainless steel to PVC.

Reason: PVC piping material is suitable for the service and is less costly. The screen will be stainless steel for well NEC1AE and PVC for well NEC27AE.

Table I-1 **LOCATION OF CHANGES**

General Comments

No.	Subject	Location of Change(s)
1	Long Term Extraction	A new paragraph(s) has been added to Section 3.1.1 (page 3-1)
2	MCLs	A new sentence(s) has been added to Section 5.1 (page 5-1) and Table 5-2 has been modified.

Specific Comments

1	Potential Drinking Water	A new sentence has been added to Section 2.2.3 (page 2-5). Incorrect abbreviations in Section 2.2.3 (page 2-5) have been corrected.
2	Respective Cleanup Levels	A new statement has been added at the end of Section 2.2.3 (page 2-6).
3	Fence Slats	New item, E, for slats has been added to specification 02831 (Appendix D).
4	Extraction Well Regulation Valves	The valves have been specified, see Section II, item 7, page C-4 of the equipment list.
5	O&MP - Carbon Exhaustion Criteria	No change to the Final Design submittal, the criteria will be included in the O&MP submittal.
6	NEC20A	Figure 6-1 has been revised. A discussion on reducing the frequency of sampling has been added to Section 6-3 (page 6-2).
7	Well Seals Description	The well seals, Item 15, of the equipment list, page C-4, in Appendix C has been modified.
8	On-Site Backfill Sampling	Item R has been added to part 3.01 of specification 02200.
9	Specific IQAT Personnel for COMP	The last sentence in Section E1.2.4, page E1-5, of Appendix E has been modified
10	Excavated Soil Materials - Backfill and Disposal	 a) Section E2.2.2 is on page E2-5. Revised section E2.2.3 is on page E2-6. Section E2.2.3 is on page E2-7. Section F3.2 is on page F3-1 and section F4.1 is on page E4-1. b) Section E2.2.2 is on page E2-5 and section F3.2 is on page F3-1. c) Section E2.2.2 is on page E2-5 and section F3.2 is on page F3-1.
11	On-site Soil Reuse	Appendix E, Section E3.2.2, page E2-5 has been modified.
12	Table E-2 Description	Table E-2 and Section E2.1.1 page E2-4 has been revised.

Table I-1 LOCATION OF CHANGES

General Comments

(Continued)

13	Drill Cuttings	The additional text has been added to section F3.3 and subsections, page F3-2.
14	Non-Hazardous Waste and Decontamination Water	The last paragraph of section F3.5, page F3-3, has been revised.
15	Table F-1 Revisions	Table F-1 will be revised.

Note: Pages referenced in the above location of change(s) column are from the draft SCGWR Final Design and minor variations in page numbering are expected between the draft and final SCGWR Final Design.

Design Development

No.	Subject	Location of Change(s)
1	Treatment Plant Pipe Material	A new section 3.5.4 on CPVC treatment plant piping has been added (page 3-9) to section 3 of the Final Design SCGWR plan. In addition the P&ID (M-001) and piping specification (15410) have been revised to reflect the change.
2	Extraction Well Pipe Material	Revised the well casing on page 3-5 and 3-6. Revise Figure 3-and section 2.02 of Specification 02230, and page C-4 of the equipment list.

Note: Pages referenced in the above location of change(s) column are from the draft SCGWR Final Design and minor variations in page numbering are expected between the draft and final SCGWR Final Design.